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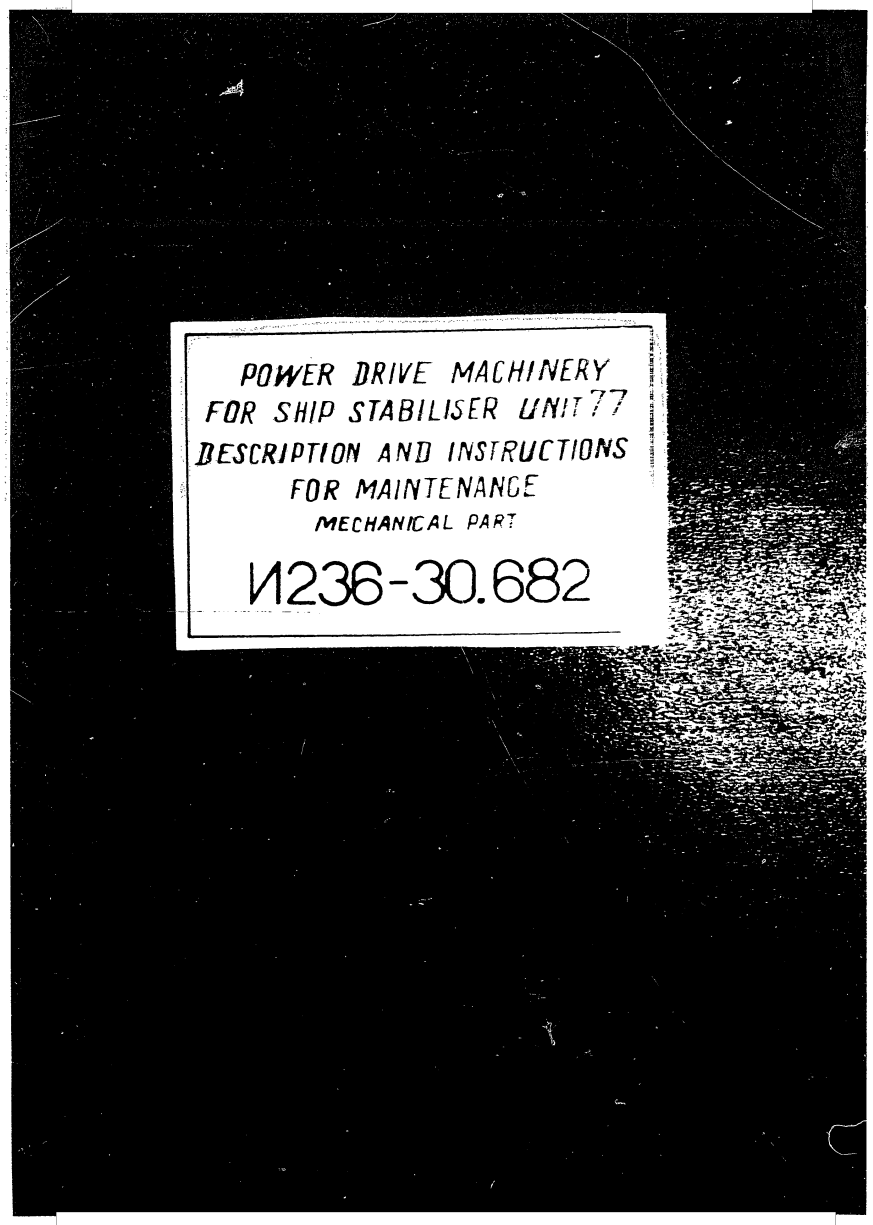

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POWER DRIVE MACHINERY
FOR SHIP STABILISER UNIT 77

DESCRIPTION AND INSTRUCTIONS
FOR MAINTENANCE

MECHANICAL PART

И236-30.682

78 sheets

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II. INSTRUCTIONS FOR MAIN ENGINE AND SHAFT STABILIZER

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I. DESCRIPTION

A. Purpose and main technical data of [redacted]

The power drive machinery of the ship [illegible] for driving stabilising fins, that is, for extending them from the side fin boxes, for tilting the fins while stabilising operates, and for housing the fins into the fin boxes.

The fins of both ship sides are tilted simultaneously in opposite directions, that is, while one side fin moves upwards the opposite side one moves downwards, and vice versa.

As the ship sails the water counterstream acts on the fins tilted from neutral position imparting a righting moment to the ship. The stabiliser is effective only when the ship is running.

The stabiliser's fin tilting gears are controlled automatically by the follow-up control units.

The follow-up control is provided:

- in the first stage - by the control units;
- in the second stage - by the hydraulic relay, the ram of which follows in a strictly proportional manner the movement of its control valve commanded by the [illegible] unit;
- in the third stage - by the linkage which receives [illegible] the commands from the hydraulic relay and the feedback [illegible] the fin tilting gear.

The power drive machinery units are arranged [illegible] and are started, shut down [illegible]

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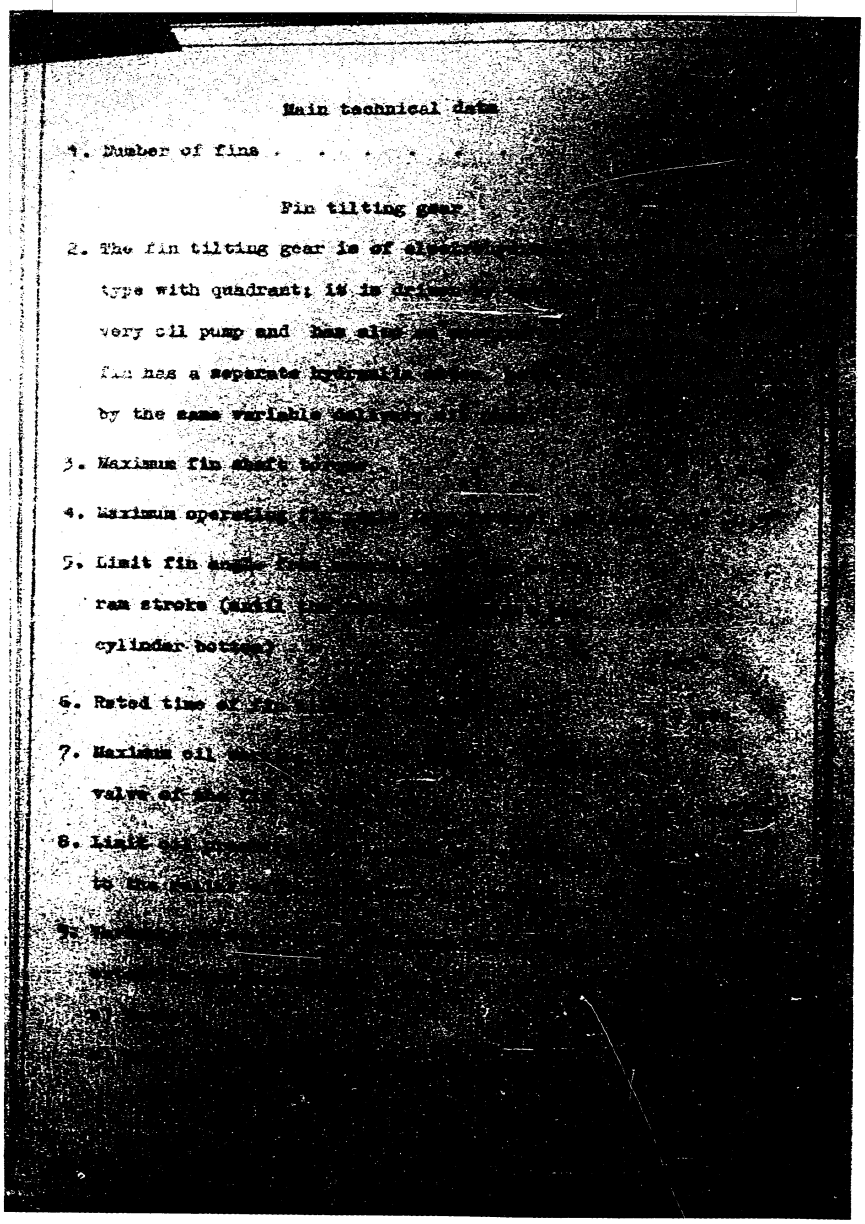

Main technical data

1. Number of fins . . . . .

Fin tilting gear

2. The fin tilting gear is of [illegible]
type with quadrant; it is [illegible]
very oil pump and [illegible]
fin has a separate [illegible]
by the same variable [illegible]

3. Maximum fin [illegible]

4. Maximum operating [illegible]

5. Limit fin [illegible]
ram stroke [illegible]
cylinder bottom)

6. Rated time of [illegible]

7. Maximum oil [illegible]
valve of the [illegible]

8. Limit [illegible]
to [illegible]

9. [illegible]

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c) Main data

Rated number of revolutions . . . . . 1000 r.p.m.

Total number of pistons 7

Piston diameter . . . . . 24 mm

Piston stroke (maximum double excentricity) 34 mm

d) Specified capacity (at 1000 r.p.m., maximum stroke of 34 mm, and oil temperature 34 - 40°C)

at discharge pressure 0 kgf/cm^2 . . . 128 l/min

at discharge pressure 30 kgf/cm^2 . . . 116 l/min

at discharge pressure 60 kgf/cm^2 . . . 105 l/min

10. Electric motor of the MHH 0,14-4 pump

a) Type . . . . . AM 72-6

b) Current . . . . . a.c.

c) Voltage . . . . . 220 V

d) Number of revolutions . . . . . 950 r.p.m.

e) Continuous power . . . . . 14 kW

f) Protection . . . . . splashproof

11. Gear pump (operated by the variable delivery pump)

a) Type - horizontal gear pump operated by the shaft of the MHH 0,14-4 pump

b) Maximum discharge pressure . . . . . 3 ± 0,5 kgf/cm^2

c) Actual capacity at discharge pressure 3 kgf/cm^2 and r.p.m. corresponding to the r.p.m. of the MHH 0,14-4 pump shaft . . . . . 12,1 l/min

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12. Accumulator - of air piston type, in vertical position, with one air bottle

a) Inside diameter of cylinder . . . . . 200 mm

b) Working volume (above piston) . . . . . 18 l

c) Maximum working pressure . . . . . 54 kgf/cm^2

d) Pressure corresponding to the relief valve adjustment . . . . . 62^{+3} kgf/cm^2

e) Air bottle capacity . . . . . 80 l

13. Hydraulic relay (one for both fin tilting gears) - of horizontal type with differential ram and control valve built in this ram

a) Maximum working stroke of the ram and control valve from neutral to limit position . . $\pm$ 43 mm

b) Maximum rated working pressure in hydraulic relay . . . . . 8,4kgf/cm^2

14. Gear pump of hydraulic relay

a) Type - Horizontal, with electric motor

b) Maximum working discharge pressure . . . 10 kgf/cm^2

c) Capacity at 10 kgf/cm^2 and shaft speed 1450 r.p.m. . . . . 50 l/min

15. Electric motor of the hydraulic relay gear pump

a) Type . . . . . AOM 41-4

b) Current . . . . . a.c.

c) Voltage . . . . . 220 V

d) Number of revolutions . . . . . 1420 r.p.m.

e) Power . . . . . 2,2 kW

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16. Oil cooler - of horizontal shell-and-tube two-pass type

a) Capacity . . . . . 30[illegible] kg/h

b) Cooling surface . . . . . [illegible] m²

c) Tube diameter . . . . . 16/14 mm

17. Emergency hand pump (one pump for each fin tilting gear)

a) Type - hand pump of two capacities

b) Full discharge pressure . . . . . 10/50 kgf/cm²

c) Capacity at full discharge pressure and 15 strokes per minute . . . . . 2/6,33 l/min

Note: The hand pumps are used also for emergency extending and housing of the fins.

Fin extending and housing gear

18. The fin extending and housing gear is of electrohydraulic two-cylinder piston type; it is driven by the electric variable delivery oil pump and has also an emergency hand oil pump. Each fin has a separate hydraulic motor for fin extending and housing both of which are operated by the same variable delivery MHM 0,194-4 pump.

19. Maximum axial force while extending or housing one fin . . . . . 5,0 tf

20. Time of extending or housing . . . . . up to 2 min

21. Fin shaft stroke while extending or housing . . 1360 mm

22. Maximum rated oil pressure in cylinders:

a) While housing the fins . . . . . 52,4 kgf/cm²

b) While extending the fins . . . . . 36,8 kgf/cm²

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23. Limit pressure in cylinders corresponding to relief adjustment:
    a) While housing the fins . . . . . 62 kg/cm²
    b) While extending the fins . . . . . 50 kg/cm²

24. Variable delivery pump - see clauses 9 and 10 of this description.

25. Emergency hand pump - see clause 17 of this description.

26. Oil grade - "Turbine oil 46" or "Turbine oil 30" acc. to ГОСТ 32-53 (distillated oil treated by sulphuric acid with antioxidant additive). Working surfaces and gearings should be greased with grease ЦИАТИМ-203 acc. to ГОСТ 8773-63.

27. Estimated dry weight of power drive machinery for tilting, extending and housing the fins of the ship stabiliser, with the electric equipment but without spare parts and special tools acc. to Technical terms of delivery . . up to 6000 kg.

28. Weight of oil in the cylinders, pipe lines, reserve and replenishing tanks, oil cooler and accumulator . . 500 kg.

29. Weight of water in the oil cooler . . . . 30 kg.

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[redacted]

[redacted] General description of [redacted]
and description of the [redacted]

General arrangement
Drawings 1,2,3

[redacted] machinery of the ship stabilizing system

[redacted] units:

[redacted] extending and housing gears 2 with their [redacted]

[redacted] tilting gears 1,

[redacted] variable delivery pump 7 with electric motor,

[redacted] accumulator 4 with air bottle 5,

[redacted] control valves 9,

[redacted] hydraulic relay 10,

[redacted] linkage 17 for tilting gear control valves,

[redacted] gear pump 21 with electric motor,

[redacted] fin extending and housing gear control valve 11 with linkage ,

[redacted] oil cooler 6, reserve tank 13, replenishing tank 14,

[redacted] filters and special fittings,

[redacted] two emergency hand pumps 18.

The shafts of both fins are arranged in one cross-section plane of the ship at 20° angle.

The fins in extended (working) position protrude beyond [redacted] lines of the ship, and are fully retracted into the fin [redacted]

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[redacted] and housing is accomplished by the [redacted] control valve.

[redacted] gears are mounted inside the ship; [redacted] piston rod ends connected with the fin shaft crossheads [redacted] into fin boxes. In places of passing through the ship hull into the fin boxes the rods are sealed by stuffing boxes mounted on the fin box bottoms.

The pistons of the fin extending and housing gears are moved by pressure oil delivered by the variable delivery MTH 0,14-4 pump into corresponding cylinder spaces. The extending and housing gears are controlled by means of the fin extending and housing control valve linkage handle which, according to the accomplished manoeuvre, should be set to "EXTENDING" or to "HOUSING" position. The control valve connects the discharge pipe line of the MTH 0,14-4 pump with the upper (while extending) or lower (while housing) cylinder spaces. The cylinders are located in the plane of fin neutral position on both sides of the fin shaft and fastened to special beams of the extending and housing gear supporting structure; besides these beams are designed to support the upper fin shaft and retracted inside the ship hull while housing as well as to prevent its rotation while housing and extending.

While stabilising the fins are tilted by the fin tilting gears. The MTH 0,14-4 pump delivers oil always in the same direction; reversing of the oil flow supplied into the gear cylinders and, hence, changing of the fin tilting direction is accomplished by

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the control valves 9 operated by the control units [illegible] hydraulic relay 10 and linkage 17. The control valves [illegible] the tilting speed by changing the width of the slot, through which oil passes from the variable delivery pump to the tilting gear cylinders.

The hydraulic relay 10 is operated by the oil gear pump [illegible].

The accumulator 4 is included in the discharge pipe line of the MHH 0,14-4 pump to provide the necessary fin tilting speed. The 80 l capacity air bottle 3 serves as a pneumatic part of the accumulator.

In case of failure of the power drive (variable delivery pump or its electric motor) the fins can be retracted into the ship side boxes by means of the hand pumps 20. These pumps are also connected with the tilting gear cylinder pipe lines, making possible to bring the fins into neutral position before housing.

The power drive machinery is provided with the following indicating and measuring instruments:

a) pressure gauges on the MHH 0,14-4 pump pipe line, hand pump pipe lines, extending and housing pipe lines, MHH 0,14-4 lubricating pipe line, pressure- and drain lines of the hydraulic relay pump, fin tilting gear drain line, and accumulator;

b) thermometers on the hydraulic relay pipe line ahead and [illegible] the oil cooler;

c) oil level gauges on the pump-unit sump, reserve and [illegible]

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ing tanks

d) tilting angle scales on the fin tilting gears;

e) excentricity indicator on the variable delivery pump;

f) mechanical indicators of the tilting gear control valve;

g) mechanical indicator of the hydraulic relay ram and control valve stroke.

Limit switches for signal lamps are provided on the fin extending and housing gears. The linkage of the fin extending and housing gear control valve is fitted with an electric blocking device.

Operating principle of the stabiliser's machinery
Drawings 1, 2, 3 and 35

The rules of ship stabiliser's use depending on the ship speed and sea condition are determined by the special Instructions for maintenance of the stabiliser.

When not in use the fins should be retracted in the fin boxes, the pointer on the scale "A" of the "OK"-unit, drawing 12, in zero position, the ram of the hydraulic relay and the rams of both fin tilting gears in neutral position. For stabilising the fins should be extended from the fin boxes. Fin extending and housing can be accomplished only at operating control units and the "OK"-unit pointer on the scale "A" at zero position. When this pointer is at zero, and the hydraulic relay and tilting rams of both fins are in neutral position the electromagnet circuit of the extending and housing control valve linkage closes and releases the handle

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housing control valve handle into neutral position.

To start the ship stabiliser turn the "OK"-unit handwheel until the pointer of the scale A coincides with the commando fin angle. Thereat the stabiliser operates for reduction in roll. After the pointer of the "OK"-unit scale is moved from neutral position, the electromagnet circuit of the fin extending and housing control valve handle will break, and the handle will be locked automatically in neutral position. The speed changing and reversing of fin motion are accomplished automatically by the "ПУ"-1 and "OK"-units.

The input signal from the "ПУ" -1 amplified by the hydraulic relay and linkage is inserted into the tilting gear control valves, which admit oil delivered by the НШ 0,14-4 pump to the tilting gear cylinders. The rams of these cylinders tilt the fins and, at the same time, return the control valves to neutral position through the linkage. The power drive machinery provides the follow-up control tilting of fins with desired speed according to the commando from the control units.

The "OK"-unit is designed to limit the fin tilting angle depending on the ship speed, and to start and stop the power drive machinery of the fin tilting gear.

To stop the stabiliser set the pointer of the "OK"-unit to zero position; thereat both fin tilting gears are brought into neutral position and stopped. With tilting gears being in this position the fins are ready to be retracted in the fin boxes. The contacts

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of the electromagnet which blocks the fin extending and housing gear control valves are closed, the handle controlling the control valves is released. For retracting the fins in the fin boxes set the handle to "HOUSING" position. Oil delivered by the pump will be supplied into the lower spaces of the fin extending and housing gear cylinders, and the cylinders retract the fins. The fin housing being finished, and signal lamps "FIN HOUSED" lighted up, the aforementioned handle must be set on neutral position, and the retracted fins stopped by the mechanical stops. Thereafter the motors of the fin tilting gears and hydraulic relay pumps should be switched off.

1. Fin extending and housing gear with supporting structure

Drawing 4

The starboard and port fins have separate extending and housing power gears consisting each of the following main parts: Two cylinders 27 with covers 25 and 28, pistons 39, piston rods 44, and supporting beam 24. Each piston is fastened to the rod 44 which passes through the stuffing box in the fin box bottom and is removably jointed with the crosshead bracket. The piston rod is sealed by the rubber packing rings 41.

The inserted stops 9, are provided on the supporting beam to hold the fin shaft [illegible] during [illegible] period of idleness.

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The supporting beam has also stops which limit the stroke of the fin shaft with quadrant. The upper stop limits the retracting and the lower one the extending of the fins. The lower stop is used also as a guide for the quadrant while the fin tilting gear operates.

The supporting beam guides must be greased by hand with consistent grease after each fin extending or housing operation. The bearing surface "K" of the lower stop should be greased by means of compression grease cups.

Operating principle
of the fin extending and housing gear

Oil delivered by the KHH 0,14-4 pump via the extending and housing control valve is supplied into one of the cylinder spaces. Oil from the opposite space is drained simultaneously into the pump-unit sump. The piston rod transmits the piston motion to the fin shaft crosshead which moves together with the fin shaft along the fin box guides. The fin is extended when oil is supplied into the upper space of the cylinder, and retracted when oil is supplied into the lower space.

2. Fin tilting gear

Drawing 5

The starboard and port fins have separate hydraulic tilting gears consisting each of the following units: pump, two hydraulic cylinders 62, 72, rod 73, beam 82 and [illegible]

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The coaxial cylinders are connected by two rods 58,67 and beam 82. The rod 58 guides the ram moving along the axis of the cylinders and prevents its rotation. The ram is sealed by means of stuffing box with four packing rings 70. The middle part of the ram is made in the form of a rack, to which the guide rod 52 is attached. The latter is designed to direct the quadrant teeth to the ram rack teeth while extending the fin shaft.

The scale 55 graduated according to the fin shaft tilting angle graduation is attached to the rod 67. The quadrant 65 is keyed to the fin shaft head. The quadrant hub has two side lugs with bronze bushes 66. While extending or retracting the fins the quadrant together with the fin shaft moves along the fin extending and housing gear axis, the bronze bushes 66 being sliding over the guides of the supporting beam 24. The guide rod and the bush of the end piece 57 are greased by means of compression grease cups, and the gearing is greased directly by hand. A limit switch with linkage is fitted on the fin tilting gear for the fin blocking. To relieve the load from the tilting gear cylinders special sight sheets are provided with shut-off valves.

Operating principle of the fin tilting gear

Oil delivered by the NSh 0,14— pump is supplied into one cylinder space and provokes ram movement. The rack of the ram transmits motion to the quadrant and fin shaft. Simultaneously

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oil from the other cylinder space is discharged into the pump-unit sump. To release air from the cylinders shut-off valves in the sight chests should be opened; as a result air together with oil will be released into the sump. The shut-off valves should be closed with oil in the sight chests without air bubbles.

3. Fin tilting gear pump unit
Drawing 6

The fin tilting gear pump unit is designed to supply oil into the hydraulic cylinders of the fin tilting and fin extending and housing gears. It consists of the following main parts: The variable delivery MEV 0,14-4 pump, electric motor, sump 96, elastic coupling 87, and control valve 95 of the regulating unit.

The electric motor is connected with the pump shaft by the elastic coupling. The motor is bidirectional, with counter-clockwise rotation when seen from the [illegible] side of the pump inlet and outlet connections.

a. Variable delivery MEV 0,14-4 pump
Drawings 7 and 8

The electric variable delivery MEV 0,14-4 oil pump is of horizontal radial piston type. Variation of pump delivery is attained by changing displacement value of the pump sliding part from neutral position, i.e. by changing the eccentricity.

The pump sliding part displacement is accomplished by the delivery regulating unit consisting of the control valve 95 and

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brackets 137,139 mounted on the pump casing and serving as cylinders with pistons 135,134. The sliding part of the MHE 8,16-4 pump is displaced only in one direction, therefore the pump supplies oil into the discharge pipe line also in one direction. Oil is supplied into the different tilting cylinders spaces and extending and bending cylinders spaces through the control valves 9 or 11.

The MHE 8,16-4 pump consists of the following main parts; the casing 116, cover 118, rotor 109, trunnion 104, pistons 113, sliding part, driving shaft 124, and gear pump 128. The trunnion 104 having four borings is fastened in the casing 116. Two upper borings connect with upper (discharge) pump-casing connection, the lower borings with the lower (suction) one. The rotor 109 with nine borings being the cylinders for pistons is fitted on the cantilever end of the trunnion. The rotor cylinders are connected with the trunnion borings.

The sliding part of the pump, by which movement the excentricity is attained, consists of the slides 105,115, floating ring 114 with covers 111,112, and bearings 107,117.

The excentricity value can be seen on the scale 141. The lubricating gear pump 128 operated by the driving shaft 124 is mounted on the pump cover 118.

Operating principle of the pump

The operating principle of the variable delivery pump (see Figs.

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1 and 2) is the following: When rotation axes of the rotor and floating ring coincide (see Fig. 1) the pistons of the rotating rotor do not reciprocate in their cylinders. But if the floating ring is displaced together with the slide some excentricity arises ("e"), and pistons start reciprocating in their cylinders. With floating ring displaced to the right from the rotation axis (see Fig. 2) and counter-clockwise rotation of the rotor the volume of the space under pistons which are above A - A axis will decrease, i.e. the pistons will deliver oil. The space under pistons which are below A - A axis will increase, i.e. they will suck oil.

From the upper cylinders oil is supplied into the pipe line via two upper trunnion bearings and upper casing connection. Simultaneously oil is sucked into the lower cylinders via the lower casing connection and lower trunnion bearings.

SCHEMATIC VIEW OF THE VARIABLE DELIVERY
MIN 0,14-A PUMP

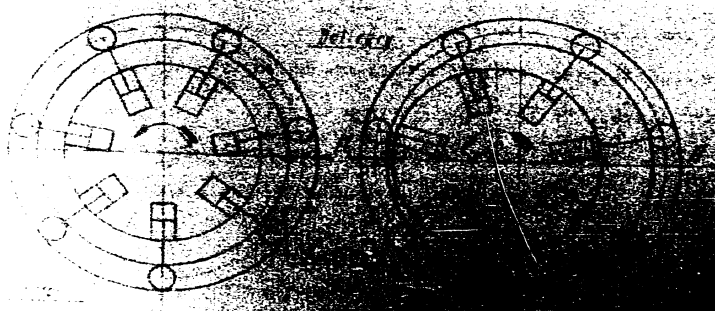

Fig. 1

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The principle of the delivery regulating unit operation is the following: The space between the piston 135 and cylinder 155 bottom is connected with the discharge pipe line of the hydraulic relay pump. The space between the piston 154 and cylinder 153 bottom is connected via the control valve 95 with the discharge or drain pipe line of the hydraulic relay. The oil pressure in the MNN 0,14-4 pump discharge pipe line being decreased, the control valve connects the cylinder 155 space with hydraulic relay discharge pipe line; in this case both cylinder spaces are under pressure. Because of piston areas difference the pump sliding part is displaced in the direction of the piston 135, i.e. excentricity increases. The oil pressure in the MNN 0,14-4 pump discharge pipe line being increased above the specified one, the cylinder 155 space is connected with the drain pipe line by the control valve. Oil pressure acting on the piston 135 provokes displacement of the pump sliding part in the direction of the piston 154, i.e. excentricity decreases.

The excentricity change provokes the change of piston stroke and, hence, the change of pump delivery too, which can be varied from zero to full value. The pump is lubricated by working oil.

b. Control valve of the delivery regulating unit
Drawing 9

The control valve of the delivery regulating unit is designed to control the MNN 0,14-4 pump. Control is accomplished by

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ing to pressure in the pump discharge pipe line.

The control valve consists of the following main parts: The case 159, sleeve 167, piston 165, spool 166, spring 171, and throttle 163.

The case 159 has three lugs with tapped holes for connecting with pipe lines; the upper hole "A" is connected with the discharge pipe line of the hydraulic relay gear pump, the middle one "C" - with the cylinder 153 of the MNH 0,14-4 pump, and the lower one "B" - with the drain pipe line.

The bottom cover 160 has a tapped hole "D" for the pipe connecting the valve with the MNH 0,14-4 pump discharge pipe line, and a hole for changing the throttle while adjusting the delivery regulating unit at Manufacturer's plant.

Operating principle of the control valve

From the MNH 0,14-4 pump discharge pipe line oil is supplied into the space under the piston 165 via the hole "D", and at normal pressure is counterbalanced by the spring 171. Thereat the spool 166 is at rest and closes the ports of the sleeve 167 serving to let oil pass from the hydraulic relay pump into the connection "B" and the pipe line connecting the control valve with the cylinder 153 of the MNH 0,14-4 pump.

In case of pressure decrease under the piston the spring moves the spool downwards, opens the ports and lets oil pass from the hydraulic relay gear pump into the cylinder 153, as a result eccentricity and MNH 0,14-4 pump delivery will in-

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In case of pressure increase in the MHH 0,14-4 pump discharge pipe line the piston will compress the spring, move the speed governor and connect the cylinder 153 space with the drain; the delivery regulating unit will decrease the excentricity and, hence, the pump delivery.

c. Pump sump
Drawing 6

The sump is designed for installing the MHH 0,14-4 pump, electric motor and control valve of the regulating unit. Its form is like that of an oil tank. There is an oil level gauge column with limit oil-level marks mounted on the sump. The purpose of all the plugs on the sump can be seen in the drawing 6.

Cleaning of the sump is accomplished through the manholes with covers 86, 97.

d. Accumulator
Drawing 10

The accumulator consists of the following main parts: the cylinder 187, two covers 185, 192, and piston 190 sealed by the lip seals 191. On the upper cover 185 there are the signal lamp switch, air filter [illegible], screw connection 202 for air releasing from the gas space, and plug 204 for oil filling. On the lower cover 192 the signal lamp switch and screw connection 197 for releasing air from the lower part of the accumulator are provided. The accumulator has the air bottle 484 with the head

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483, two shut-off valves 480,485, and relief valve 402 (see drawing 27). The accumulator can operate only being in vertical position.

Operating principle of the accumulator

The upper (above piston) space of the accumulator is connected with the air bottle and contains air compressed up to specified pressure. The bottom (under piston) space is filled with oil and connected with pump discharge pipe line. If pump delivery is excessive pressure in the pipe line rises and oil is supplied into the accumulator, raising air pressure in the upper space. When the fin tilting gear operating the compressed air which acts upon the piston forces out oil into the discharge pipe line.

The switches on the accumulator covers are designed to switch in the lamps signalling the accumulator fully charged or fully discharged. With the accumulator operating normally the piston moves in the middle part of the cylinder, and the signal lamps are out.

5. Control valve of the fin tilting gear
Drawing 11

The fin tilting gear control valve is designed for reversing oil flow supplied into the fin tilting gear cylinders.

The control valve consists of the following main parts: the casing 208, spool 211, rod 209, cover 207, damper body 215, damper rod 216, piston 217, and cover 220.

The spool 211 is loose fitted on the rod 209 and is prevented from axial displacement. With the control valve in middle po-

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when the pointer 222 coincides with the notch on the rod 226. There are five bosses with tapped holes for pipe line connections on the casing. The middle side hole is connected with MNH 0,14-4 pump discharge pipe line; both end side holes are connected with the drain. The bottom holes are connected with the fin tilting gear cylinders via the pipe line. On the cap of the cover 220 two holes are provided; one of them is closed by the plug and serves to release air while filling the system with oil, the other hole serves for connecting with the drain pipe line.

Operating principle of the control valve with damper

The spool, moving axially, connects the MNH 0,14-4 pump discharge pipe line with one of the tilting gear cylinders; simultaneously the other cylinder is connected with the drain pipe line. The spool rod moves the damper piston, oil being displaced from the one of damper-body chambers into the other via the adjustable valve. The damper piston absorbs axial shocks and provides smooth displacement of the spool.

3. Hydraulic relay and control units
Drawing 7a

The hydraulic relay and control units are mounted on the supporting beam 231. The linkage between the control units and hydraulic-relay control valve consists of the bearing with arm 232, tie-rod 229, and rod 234. The spring tie-rod is designed

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[illegible] protect the "OK"-unit or hydraulic-relay control valve against [illegible] any part of the unit is jammed. It is designed in such a manner, that the springs always are working as compression ones irrespective of force direction. Mounting load of the springs is adjusted according to maximum design working load transmitted by the "OK"-unit handle, hence the spring tie-rod works normally as rigid link. Linkage pivots are greased by means of grease cups.

7. Hydraulic relay
Drawing 13

The hydraulic relay of the fin tilting gears is designed to operate the tilting gears control valves. It consists of the casing 247, end covers 242,245, differential ram 244, and spool 246 built in the ram. By means of bronze rings 243 fitted on the ram the cylinder is divided into four chambers - supply pressure chamber, variable pressure chamber, drain chamber, and constant pressure chamber. The ram area on the side of variable pressure chamber is twice the ram area on the side of constant pressure chamber.

On the casing there are four upper bosses with tapped holes for connecting the air release pipe lines. In the lower part of the casing there are three bosses with tapped holes; two side holes are designed for connection with the discharge pipe line of the hydraulic relay pump, the middle one for connection with the oil drain pipe line. The ram 244 is provided with boring and drilling [illegible] connecting the supply pressure chamber with variable pressure chamber and drain chamber. The spool is [illegible]

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[redacted] 238 with clearance for lateral selfadjusting and is [redacted] against axial displacement by nuts 248. Lip seal 259 [redacted] sealing are provided for rod sealing. To prevent oil [redacted] through the gland outwards oil drain is provided from [redacted] 232 into the drain pipe line.

Operating principle of the hydraulic relay

[redacted] hydraulic relay realizes the second amplifying stage, the [redacted] operation being provided by the ram.

[redacted] hydraulic relay control valve operated by the [redacted] the variable pressure chamber with the discharge pipe [redacted] of the hydraulic relay pump or with the drain pipe line. [redacted] spool of the control valve moves along the ram axis and opens [redacted] ports; as a result the ram moves too, and following the spool [redacted] oil ports and then stops, i.e. it repeats in full the spool [redacted]. If the ram lags behind the spool the slot in the sleeve [redacted] will increase with subsequent increasing of oil flow rate [redacted] ing of ram moving speed. If the ram leads the spool the [redacted] will decrease, hence oil flow rate and ram moving speed will [redacted] too.

[redacted] linkage for tilting gear control valves

Drawing 14

[redacted] linkage is designed to govern the tilting gears engaged [redacted] consists of two similar [redacted]

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the ship) connected by tie-rods 270,271 with common lever, transmitting motion from the hydraulic relay ram.

Each separate linkage-unit represents a system of rods, levers and balancing beam connected with each other in such a manner that a certain leverage is provided. The linkage consists of the following assemblies: tie-rods 269,270 or 274,271, tie-rod 276, bracket with angle lever 268, balancing beam 275, bracket with lever 267 or 275, and tie-rod with springs 272.

All the tie-rods are rotatably connected with their mating parts. The rod forks with right - and left-hand thread make possible to regulate the length of the rods while adjusting the linkage. The rod with springs 272 is designed for preventing linkage damage in case of any linkage part being jammed.

The springs with their seats are mounted on the rods and compressed up to mounting length by nuts. The tie-rods are of such design that the springs are working only as compression ones, irrespective of the force direction.

The mounting load slightly exceeds maximum design working load and the linkage normally acts as a rigid link; springs compression takes place only in case of working load being exceeded. The shaft, angle levers, balancing beam journals and axles of all the rotatably connected parts are greased by means of grease guns.

Operating principle of [illegible]

The linkage [illegible] by the hydraulic relay valve spools of the fin setting gears [illegible]

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pumped via the [illegible] is supplied into the cy[illegible]
gears and rams of these gears begin the [illegible]
simultaneous returning of the spools into [illegible]
linkage and closing the valves ports.

Due to the balancing beam [illegible] by the hydraulic relay and the tilting [illegible] operation is realized.

With the tilting gear [illegible] the slot in the control valve ports [illegible] of passing oil increases as well; this [illegible] of the tilting gear ram and fin tilting speed and [illegible] the tilting ram moves ahead the [illegible] the slot decreases causing the reduction of oil [illegible] speed of fin tilting [illegible]

9. [illegible]

The electric gear [illegible] electric motor counterbalance [illegible] mounted on a common [illegible] rational and rotates [illegible] gear rim.

Operating principle

With the driving pinion [illegible] the drawing, oil is sucked [illegible]

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tapped hole of the "b" connection and is pumped into the pipe line via the "a" connection.

10. Control valve of fin extending and housing gear with linkage
Drawing 17

The control valve of the fin extending and housing gear assembled with linkage is designed for controlling the fin extending and housing gears. The control valve 299 and the linkage bracket 300 are mounted on the welded frame 298.

Control valve of fin extending and housing gear
Drawing 18

The control valve consists of the following main parts: the casing 338, cover 336, sleeve 337 and spool 340. There are five lugs with tapped holes on the casing for pipe connection; two extreme holes are connected with the drain pipe line, the middle one with the discharge pipe line of the MNN 0,14-4 pump, and the two side holes with the pipe line of the extending and housing cylinders. There is a pointer 339 mounted on one of the studs securing the right-hand cover to the casing. The spool being in neutral position the pointer coincides with the mark on the rod.

Operating [illegible]

MNN 0,14-4 pump delivers [illegible]
via the hole "b" with the [illegible]
"d" and "e" are closed.

While the spool rod is [illegible]

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resting against the cover the spool connects the pump discharge pipe line with one of the chambers of the fin extending and housing gear, and at the same time the opposite chamber is connected with the drain pipe line.

Linkage of fin extending and housing gear control valve
Drawing 17

The linkage is designed to control the fin extending and housing gear control valve. It consists of the following main parts: the linkage bracket 300, lever 308, socket 320 with spring levers, stops, and electromagnet. The stop rod 326 is connected with the blocking electromagnet by the linkage.

Operating principle of linkage

The electromagnet is interlocked with "OK"-unit and fin tilting gears of both sides. Electromagnet circuit closes only when the "OK"-unit and both tilting gears are in zero (neutral) position. When contacts are closed the electromagnet turns the lever 304 and disengages the stop rod 326.

Then the hand stop is released by the handle 307 and depending on the required operation the lever 308 is turned either to the "EXTENDING" or to "HOUSING" position indicated by the pointer on the plate which is attached to the casing 310.

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11. Oil cooler
Drawing 19

The oil cooler is designed to cool the oil supplied from the drain pipe line of the hydraulic relay into the MHM 0,14-4 pump sump. It consists of the following parts: the shell 347, two tube plates 346 and 353 with tubes, and two covers 354, 358.

There are two holes for air release and oil drain plugs 350 and two welded bosses with tapped holes for oil pipe line connection. Three holes with welded flanges and cover 356 are provided on the lower part of the shell for oil cooler cleaning. There are two tapped holes in the cover 358 for cooling water inlet and outlet. In the shell cover protectors 355 are provided.

Operating principle of oil cooler

Hot oil enters the shell via one of the upper holes and flows outside the tubes in the direction indicated by arrows; it drains through the other hole on the opposite end of the shell. Cooling water enters via one of the holes into the cover 358, flows inside the tubes and drains via the other hole.

12. Reserve tank

The reserve tank serves for hydraulic oil storage to compensate leakages. A hose with tapped hole for pipe line connection is welded to the lower part of the tank side wall; oil-level gauges are provided on this side as well. A manhole for tank cleaning, closed by the cover with gasket is provided on the front side.

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The gauze candle through which the tank is filled is inserted in the hole on the upper wall.

13. Replenishing tank

The replenishing tank is designed to provide pressure head in the pipe line of the hydraulic relay while the machinery is idle. Tank capacity is 15 l. Tank filling may be accomplished by pumping oil from the pump sump by hand pump, or by hand through the upper hole closed with a cover.

14. Oil filters
Drawing 20

The drain pipe line of the tilting gear control valve and the drain pipe line of the hydraulic relay include one oil filter each. The filters are designed to filter oil drained into the pump sump. The filter casing has two screw connections for pipe line and a tapped hole in which a brass column 355 with axial boring and side holes is screwed-in. The upper disk 366, lower disk 362, and intermediate disks 363 with gauze 364 between each two of them are mounted on this column and form a filter candle assembled.

The direction of oil flow is indicated by arrows in the drawing.

15. Hand pumps
Drawing 21

The hand pumps are designed for emergency setting of the [illegible] into neutral position, for emergency fin extending [illegible]

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for filling the pipe lines with oil, and pumping oil from the MKM 0,14-4 pump sump into the replenishing tank. The hand pump consists of the following main parts: the casing 378, cover with valve body 379, two ball-valves 394,394, rod 393, handle 392, and change-over handle 396.

The rod-piston is hollow with oval flanges in the upper part; to this flange grips 380 are secured. Inside the rod-piston 384 the rod-piston 384 of smaller diameter is arranged, its upper end being screwed into the steel rod 382 connected with the lever 382. The pump casing is closed by the cover 377 with pressed-in bush 381, through which the guide rod-end 384 with collar passes. Between collar and bush a shock absorbing ring is mounted. The lower end of the rod has a thread with two slots for the 385. Stops for large-diameter piston are provided on the wall of the pump casing. To change-over from the inner to the outer one, and vice versa, the handle 396 with the stop 395 is provided. The valve body 379 is screwed into the casing. On this body there is a screw connection with adjustment for supply pipe line; besides, there are lower screw connection 381 for the suction pipe line and upper screw connection 378 for pressure gauge pipe line screwed into the body.

Operating principle of the hand pump

The pump is designed for two-duty operation: at 50 kgf/cm^2 with small-diameter rod-piston, and at 10 kgf/cm^2 with large diameter rod-piston; the delivery changes respectively.

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[redacted] bolt 394 the handle 393 should [redacted] until the plate of the rod 393 pass beyond [redacted], and the change-over handle 393 should be turned [redacted]; thereat the rod-pistons 384 and 384 will be engaged with their plates, and the oval flange released from the locking plates 397.

To operate with small rod-piston the large one should be lowered to lower position, turned to the right by the change-over handle 393, and locked by the stopper 395. Thereon the oval flange will be fixed by the locking plates 397.

16. Limit switch for fin housing signalling
Drawing 21

The limit switch for fin housing signalling is designed to close the contacts of the signal lamp circuit when the fin shaft attains its limit position in the fin box. The limit switch is mounted on the end of the aft supporting beam of each fin extending and housing gear and consists of the switch proper, the tie-rod with spring device 407, bracket 400, and lever 411.

As the quadrant approaches its upper position the plate 414 fastened to the quadrant hub turns the lever 411 and closes the limit switch contacts. As a result "FIN HOUSED" signal lamp lights up.

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17. Limit switch for fin extending signalling
Drawing 46

The limit switch for fin extending signalling is designed to switch in the "FIN EXTENDED" signal lamp. It is mounted on the end of the aft supporting beam of each fin extending and locking gear. As the quadrant approaches its working position the quadrant hub turns the lever 426 and closes the limit switch contacts. As a result the "FIN EXTENDED" signal lamp lights.

18. Indicators

The indicators are designed for adjusting the trackers, watching the operation of installation while testing.

a. Stroke indicator of fin tilting gear control valve
Drawing 7

This indicator is attached to the control valve casing at the end of the fin tilting gear on the spool rod side. The shaft has the eccentric bush 448 which is designed to change the backlash of the rack-and-pinion gearing. By rotation of this bush one can change the centre distance and, hence, attain minimal backlash. Thereafter the bush will be tightened by means of locking nut.

With the rod moving a lever moves the rack which, in its turn, rotates the pinion with the pointer fastened to it. The rod displacement in mm is indicated on the scale 447 by the pointer 446. Zero position of the pointer corresponds to neutral position of the control valve.

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b. Hydraulic relay stroke indicator
Drawing [illegible]

Hydraulic relay stroke indicator which is mounted on the beam 230 (see drawing 34) consists of the casing 467, scale 472, two racks 473, 474 sliding here in the flanges 475, two pinions 469, 471. The rack 473 engages the pinion 471 which is connected with the rod of the hydraulic relay by means of the link 476. The pinion 471 is rotatably mounted on the shaft of the pointer 468 and prevented against axial displacement.

The pinion 469 with shaft engages the rack 474 which is connected with the spool rod of the hydraulic relay by the linkage. Pointers 467 and 470 are rigidly attached to the pinion 471 extension and to the end of the pinion 469 shaft respectively. To the casing of the indicator the scale 472 is fastened, where the pointer 470 indicates the spool displacement, and the pointer 469 - the hydraulic relay ram displacement. When the hydraulic relay operating the pointer 469 lags behind the pointer 470 by value equal to the slot in the sleeve ports opened by the spool 346 to supply oil.

19. Relief valves
Drawing 36

The relief valves are designed to by-pass oil from the supply pipe line into the drain one when pressure exceeds the specified one. The valve 503 (see drawing 35) is to be mounted on

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the MBH 0,14-4 pump pipe line and the valve 700 mm [illegible] on the pipe line connecting the extending and lowering control valve with the extending and lowering [illegible]. The valve 700 mm should be adjusted to pressure of 50^{+3} kgf/cm^2, and the valve 809 to 50^{+3} kgf/cm^2.

20. Angle relief valve
Drawing 27

This valve is designed to by-pass oil from the hydraulic relay discharge pipe line to the pump sump when pressure exceeds the adjusted one. The valve 577 (see drawing 50) is mounted on the hydraulic-relay pump discharge pipe line and should be adjusted to pressure of 70^{+3} kgf/cm^2.

21. Angle relief valves
Drawing 50

The angle relief valves 540 and 557 (see drawing 50) are designed to release air from the air pipe line of the accumulator and air bottle when pressure exceeds the adjusted one. These valves should be adjusted to pressure of 64^{+3} kgf/cm^2.

[illegible] by-pass valve
Drawing 51

The by-pass valve 570 (see drawing 55) is designed to by-pass excess oil supplied by the gear pump for lubrication of the MBH 0,14-4 pump. The valve should be adjusted to pressure of $3,5^{+0,5}$ kgf/cm^2.

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25. Pressure gauge valve
Drawing 32

This valve is mounted on the pressure gauge pipe line. The pressure gauge is screwed into the upper tapped hole of the valve body, the side hole being designed for connecting the control gauge and for releasing air from the pipe line of the power drive machinery.

24. Sight chest
Drawing [illegible]

The sight chest is mounted on the pipe line [illegible] from the cylinders of the fin actuator, [illegible] gauge, and from the pneumatic relay cylinder [illegible] cylinders is connected to the [illegible]

[illegible]. Valve chest
Drawings [illegible]

The valve chest consists of two relief valves [illegible] in brass casing [illegible]. The valves are [illegible] power drive cylinder like the spherical one and [illegible] exceeds the adjusted one. The valves are adjusted to [illegible] kg^{+3} kgf/cm^2.

26. Schematic diagram of [illegible] pipe line
Drawing 35

The diagram shows the power drive machinery units, shut-off and relief valves, filters, indicating and measuring instruments,

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[redacted]

[redacted] pipe lines. Description and operating principle of the units [redacted] are given in Section "General description of machinery and description of its units".

Main pipe line of fin tilting gears.

[redacted] line is designed to supply oil discharged by the [redacted] pump into the pressure system of [redacted] gear cylinder, and to drain oil from opposite cylinder [redacted] into pump sump. The fin tilting gear pipe line consists of three parts. The first part connects the pump 570, [redacted] tilting-gear control valve 548, and accumulator 558. On this part of pipe line the following fittings are mounted: the relief valve 603, non-return valve 564 preventing the accumulator discharge with inoperative pump, valve 562 shutting-off the accumulator, shut-off valve with pressure gauge, and by-pass valve 559.

The second part includes the variable pressure pipe line between the control valve 548 and cylinders of each fin tilting gear 520; it has the shut-off valves 621,622 in the common valve chest.

The third part includes the drain pipe line between the control valves 548 and sump 597. On the drain pipe line there are a pressure gauge with shut-off valve, oil filter 615 with three shut-off valves 542, 552, 549 allowing to cut-off the filter for cleaning and to drain oil for time of cleaning via the by-pass pipe.

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Main pipe line of fin extending and housing gears

The pipe line is designed to supply oil from the MH 0,14-4 pump via the extending and housing control valve 612 into the pressure spaces of fin extending and housing cylinders, and to drain oil from the opposite spaces into sump.

This pressure pipe line consists of two parts: one part is between the MH 0,14-4 pump and the control valve 612, and another between the control valve and fin extending and housing cylinders. In the second part of the pipe line there are the following fittings: two shut-off valves 608, 610 for cutting-off the control valve and oil throttling at the bench testing of the fin extending and housing gears; relief valves 607, 609 on the extending and housing pipe lines; pressure gauges with shut-off valves 611; shut-off valve 596 for periodic discharge of little portion of oil from housing spaces of cylinders in case of pressure rise due to leakage in the control valve 612 as the fin tilting gears operate; and four shut-off valves 592, 593, 599, and 602 providing the possibility of operation with one board gear only.

Hydraulic relay pipe line

This pipe line is designed to supply oil from the electric gear pump into the cylinder of the hydraulic relay 563 and the cylinders 565, 566 of the delivery regulating unit of MH 0,14-4 pump, and to drain oil into sump.

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The first part of this pipe line includes the pressure line between the gear pump 585 and hydraulic relay 563, and the branch line to the small piston chamber of the regulating unit cylinder [illegible] the following fittings on this pipe line: the non-return valve 574 eliminating oil leakage from the hydraulic relay with inoperative pump, shut-off valve 573 cutting-off the regulating unit control valve, relief valve 575, and pressure gauge with shut-off valve.

The second part - the variable pressure line - connects the control valve 569 with the large piston chamber of the cylinder 565 of the delivery regulating unit. This part of the pipe line can be connected with the drain pipe line via the control valve 569 or valve 560. On this pipe line serving to drain oil from the hydraulic relay and from the variable pressure chamber of the regulating-unit cylinder via the control valve the following fittings are mounted: the oil filter 576 with three shut-off valves 578, 583, 584 the purpose of which is similar to that of the filter and valves of the tilting gear pipe lines, pressure gauge with shut-off valve, and oil cooler 588. The shut-off valves 571, 560 are designed for setting the sliding part of the MNH 0,14-4 pump to neutral position before starting.

Auxiliary pipe line of emergency hand drive

This pipe line is designed to supply oil from the hand pumps into the pressure system of the extending, housing, and tilting cylinders, and to discharge oil from the opposite spaces into sump

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The pipe line of the hand pumps is the common one for the tilting and fin extending and housing gears. Oil is [illegible] in one direction, and changing-over of the pump discharge is accomplished by means of the following shut-off valves:

for the port fin tilting gear - valves 615, 617, 618, 619;

for the starboard fin tilting gear - valves 578, 580, 581, 582;

for fin extending and housing gears - valves 594, 595, 600, 601.

Description of valve manoeuvring see below.

To fill the system with oil by means of hand pumps the pipe line is provided for oil suction from the sump; this pipe line can be cut-off by means of the valve 591. Each pump can be cut-off by means of the valve 589 or 605.

Auxiliary pipe line of reserve tank

This pipe line is destined to supply oil from the reserve tank into MIN 0,14-4 pump sump. It has two shut-off valves 577 and 587 at the reserve tank and at the MIN 0,14-4 pump sump.

Replenishing auxiliary pipe line

This pipe line is destined to compensate leakage in the hydraulic relay and the machinery is inoperative. The replenishing system consists of the replenishing tank 566, shut-off valves 567 and non-return valve 568.

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Auxiliary pipe line for MHN 0,14-4 pump lubrication

This pipe line is destined to supply oil from the pressure pipe line of the gear pump 566 for lubrication of the MHN 0,14- pump. The lubrication pipe line is connected with screw connections of MHN 0,14-4 pump covers.

Auxiliary pipe lines for air release

The air release pipe lines connect the cylinders of fin tilting gears, of fin extending and housing gears and of hydraulic relay with the MHN 0,14-4 pump sump. All the air release pipe lines are provided with similar sight cheats with two shut-off valves on each of them.

Air pipe line of accumulator and air bottle

This pipe line is destined to supply compressed air into the accumulator 553. The system includes the compressed air bottle 549 provided with the shut-off valves 554, 551, relief valve 550, intermediate valve 555 cutting-off the accumulator from the compressed air line and air bottle, relief valve 557, and air filter built into the accumulator cover. The air line is provided with the pressure gauge 556 with the shut-off valve. For cutting-off the bridge compressed air line the shut-off valve 555 is provided.

The remaining pipe lines

To these belong the drain pipe lines from the glands of [illegible] hydraulic relay [illegible] and [illegible] gear control valve [illegible] and from [illegible]

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12. INSTRUCTIONS FOR MAINTENANCE OF SHIP STABILISER

Maintenance of the ship stabiliser machinery should be carried out only by personnel of proper technical skill after having studied all the instructions for maintenance.

A. Filling power drive machinery and pipe lines with oil Drawing 35

All machinery spaces and pipe lines before filling with oil should be thoroughly cleaned according to Instructions No 74015-252-63. Use turbine oil 46 or 30 acc. to TOCT 32-53. Oil should be clean, perfectly free of water and impurities, and thoroughly filtered before filling into the tanks. Before filling the system oil should be analysed. Total amount of oil in the system 500 kg.

Before filling the system close all the shut-off valves.

The filling is carried out as follows:

Fill oil in the reserve tank and replenishing tank 566 through the filter. Then open the shut-off valves 577 and 578 connecting the reserve tank with the HSU 0,14-4 pump sump and fill the sump 577, the reserve tank being continuously replenished. The sump should be filled up to the red mark of the oil level gauge. After the sump is filled close the valve 577. During the subsequent filling of the system replenish the sump with oil.

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[redacted]

. filling of tilting gears cylinders and pipe lines up to the ... valves 548 should be carried out in the following ... sequence:

... open valves of the sight chests 579 on the pipe lines for ... releasing air from the tilting gears; open the valves 578, 582, 616, 618 on the discharge lines of the hand pumps; open the valves ... on the drain pipe line; open the valves 591, 589 and 603.

Then, working with hand pump, fill the pipe line with oil. ... oil appears in the sight chests, continue pumping watching through the sight chests glasses oil flowing into the drain pipe line, with oil free of air bubbles close the sight chests valves and cease pumping. Close the valves 578, 582, 616, 618.

... Fill the tilting gears pump discharge pipe line up to the tip valves, open control valves in the following sequence: ... open the valve 616, open the pressure gauge valve 561 connecting the pipe line with the pressure gauge and the drain open the filling plugs of the tilting gears control valves; open the plug on the lower cover of the accumulator 558.

Remove the fairing 310 and disengage by hand the electromagnet stop releasing the linkage handle of the extending and housing control valve 612, turn the handle to limit "extreme" position (in drawing - to the right) and lock it in this position. Thereon fill the pipe line with oil by means of the hand pump. When oil appears in the hole of [redacted] plugs of the accumulator 558, plug this hole and screw the valve 548, [redacted]

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while filling the spool rod of the hydraulic-relay control valve should be moved to the right. Add oil into the replenishing tank while filling. As air free of air bubbles appears in the sight sheets, close the sheet valves. Close the valves 576 and 577. Set the hydraulic relay control valve into neutral position indicated by the mark on the rod.

6. The filling of the discharge pipe line of the gear pump 586 is going on while starting the motor of the MHH 0,14-4 pump.

7. Filling of diverse spaces of machinery. The damper cylinders of the fin tilting gears control valves (see drawing [illegible]) on both sides of the piston 217, and the space of the damper cover 220 are filled by hand with filtered hydraulic oil through the holes of the plugs 218.

When the pipe lines and machinery are filled; open the drain pipe lines valves 542, 552, 575, 584.

8. Accumulator charging. While charging the accumulator the piston should be in lower limit position (signal lamp "ACCUMULATOR FULLY DISCHARGED" lights). Through the top cover hole fill the accumulator with 5 litre of filtered hydraulic oil, then close the plug. Open the air-bottle valve 554 and the valve 555, and then, opening slowly the valve 557 on the ship's compressed air main, raise air pressure in the pipe line up to 7 ± 47 kgf/cm^2; thereon close the valve 553. With the accumulator operating the valves 554 and 555 should always be open. Then close the valve 542.

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If, while charging the accumulator, pressure in the air bottle and in the air space of the cylinder exceeds 4 kgf/cm^2 it is necessary to open gradually the valve 551 and reduce pressure to the specified value.

Accumulator blow-down. The accumulator blow-down should be carried out periodically to eliminate moisture from the air space. Before the blow-down release air from the air space and set the accumulator piston into the upper limit position, using the hand pump (via the fin extending and housing control valve) or by the EMN 0,14-4 pump. With the piston in this position the signal lamp "ACCUMULATOR FULLY CHARGED" should light. Thereon open the shut-off blow-down valve on the pipe line connected to the screw connection 30 and supply compressed air into the air space. After blow-down prepare the accumulator to operation by filling the air space with one litre of oil and raise the air pressure in the accumulator and air bottle up to 58 kgf/cm^2.

B. Adjustment of fin tilting gears

To provide normal operation of the ship stabiliser it is necessary to check up periodically the adjustment of the mechanical units. The starboard and port fin tilting gears being properly adjusted tilt the fins by equal amounts to forward and aft angles on the scale "A" of the [illegible]

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direction of rolling with the list of the ship to port side should correspond to values in the drawing 35.

With the pump unit started and the pointer "k" at zero on the "OK"-unit scale "A" (see drawing 12) the fin tilting rams should be in neutral position, that is at zero on the scale 35 of the fin tilting gears (see drawing 5). If the adjustment is disturbed, it is necessary to find out the place and cause of trouble, eliminate it and check up the adjustment in following sequence:

a) Check up the assembly of the linkage the forks of which should be locked by nuts and pins on their rods. Disturbed lengths of rods should be readjusted according to the above below.

b) Disconnect the rod 22) from the lever"B"of the "OK"-unit (see drawing 12); following the instructions for maintenance of the control units switch-in the "MY-1"-unit, bring the pointer on the scale "A" of the "OK"-unit to the zero point. Using the manual-list setting handle (handle for manual fin tilting) deviate the output lever "B" of the "OK"-unit to the right and to the left. Displacement of the lever "B" - articulation point should be symmetric with respect to zero position i.e. with respect to vertical line, and should be equal to $\pm$ 45 mm (along the chord). This displacement can be adjusted by regulating the length of the lever "B", which is designed in a manner allowing such a regulation. When the articulation point displacement is checked up the rod

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[redacted] should be set in the middle; then start the hydraulic-relay pump unit and check up the strokes of the hydraulic-relay ram rod which should be equal to 2 by tilting the fin tilting through the angle of 20°. In case of the ram stroke being non-symmetric, change the length of the rod 274 provided with right-hand and left-hand thread for connection with forks, without removing this rod from its place.

If the fin tilting gear has been displaced from zero it is necessary to adjust the control valve linkage. With this purpose change the length of the rod 274 of the diaphragm control valve without removing this rod. The length changing should be carried out by rotating the rod in that direction, which brings the ram into a new position acc. to the tilting gear scale 31 (see drawing [redacted]).

After adjusting all the rods should be locked with pins.

C. General maintenance and care
Drawing 43

For keeping the power drive machinery ready for use it is necessary to carry out the following maintenance and care: Systematically examine the units and measuring instruments, make sure that the machinery is in proper condition and there are no foreign objects near the working parts.

Make sure that linkages for the locking and signalling limit switches are in proper condition and check up functioning of

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signalling system by closing the contacts by hand. Thereat, with linkages and signalling system in good condition, the signal lamps should light.

11. Fill and tighten up all the grease cups, grease by means of a gun all the working parts not provided with cups, e.g. the guide surfaces of the beams 24.

12. Check up oil level in the reserve and replenishing tanks and in the pump sump by oil-level gauges.

13. Make sure of proper position of the shut-off valves: the sight cheats valves of the hydraulic relay 593, of the [illegible]-ing gear 620, [illegible] of the extending and housing gear should be closed, the sump valve 587 should be open[illegible], and the reserve tank valve 577 should be closed. The [illegible] 592, 593, 599, 603, 608, and 610 on the fin extending line and the valve [illegible] on the pipe line from the [illegible] should be opened, as well as the valves 542, 552 on the drain pipe line, and the valve 549 should be closed. The valve 560 on the cylinder pipe line should be opened, and the valve 574 on the delivery regulating unit control valve closed. The replenishing tank valve 567 and the valves 575, [illegible] on the filter pipe line should be opened, and the valve [illegible] closed. The valves 616, 617, 618, 619, 578, 580, 581, [illegible], 594, 595, 597, 600, 601, 589, and 605 on the pipe line [illegible] the hand pumps should be closed as well as the valve [illegible] the valve 589 on the discharge pipe line of the [illegible] pump should be opened.

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In the pressure gauges on all the pipe lines the valve chamber leading to the gauge should be connected with the gauge pipe line, and the blow-down chamber of this valve should be cut off, the shut-off valves 554 and 555 on the accumulator pipe line should be opened, and valve 552 closed.

14. Make sure by corresponding indicators that the rams of the fin tilting gears 620, the control valve 548 of the fin tilting gears, control valve and the ram of the hydraulic relay 563 are in neutral position.

15. Make sure that the fin shafts with quadrants are in proper position and locked by inserted stops in the support hangs.

16. During short periods of idling of the stabiliser all operating surfaces of the machinery should be greased. Besides the strict keeping of clauses 9 - 10 of these Instructions it is necessary:

a) to turn over the MBH 0,14-4 pump and the gear pump of the hydraulic relay by hand every day and check up if there is preservative grease on the rack and quadrant toothing, on the arm journals, on the guide beam working surfaces, on the fin extending and housing gears rods, and other unpainted working surfaces of the machinery.

b) Once every week blow-down the accumulator [illegible] tilting gears with housed fins. With [illegible] hydraulic relay pump, the MBH 0,14-4

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and by means of the handle for manual [illegible] the
fins through 20° ten times, with [illegible] special. Control the cooling
water pressure; if the inlet and outlet pressure differ
exceeds 0,5 kgf/cm^2, mechanical cleaning of the water
of the oil cooler is to be carried out. [illegible]
tors and clean off oxides from their surfaces.

c) Once in two weeks test the proper [illegible]
of the fins (after making sure of them overboard
them) in accordance with clause 76 of the [illegible]

d) After 2 hours operation of reassembled
main units of the machinery (i.e. gears, pumps,
hydraulic relay, and control valves) [illegible]
every 100 hours of stabilizer normal [illegible]
than once in two months, take oil sample
to check if it meets the requirements of
oil not less than once a year. The oil
cessary to clean and wash out the [illegible]
and replenishing tanks, and pipelines [illegible]
Instructions No 7401[illegible]-2[illegible].

17. Out-of-schedule inspections, three-months inspections, and special testing of machinery should be accomplished in accordance with ship's Instructions for maintenance. In case of unsatisfactory operation of any unit it should be dismantled [illegible] cause of trouble. The worn parts should be [illegible] The list of spare parts is given [illegible]

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[redacted]

...exceed the value indicated in the operating instructions, but the machinery operator [illegible] changing of parts is not necessary.

...oil leakage from the sealed e[illegible] ...rate the damage of the lip seals.

...starting and operation
...breaking-in

...prepare the power drive machinery for ... ...ensure that ... ... of "ON" connection are observed; the com...

18. Supply current to the [illegible] board of the ... ...turn for the pump ... ...ing pump and ... ...lay is set ... ...stabilizing and ... ...tem to ... ...with accordance to the ...

19. After ... ...ator on the scale "A" of "ON"-... ...the electric motor of the pump ...

... the ... pump is not zero, ... the piston of ... ...section of oil supplied by the pump ... ...part of the pump into neutral position ... ...eccentricity.

20. After checking up by [illegible] that the eccentricity ... the MM 0,4-4 pump is ... switch-in the pump motor.

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cordance with the Instructions for electric equipment maintenance.

21. As the electric motor of the MHH 0,14-4 pump gathers full speed close the shut-off valve 560 and open the valve [illegible] after having changed over the MHH 0,14-4 pump for operation with the delivery-regulating unit. Then close the by-pass valve 559.

22. Remove the inserted stops holding the fin shafts [illegible] rants in upper position. If the quadrant prevents swinging, put the handle controlling the fin extension [illegible] control valve 612 into the "HOUSING" position. [illegible] stops and thereon move the handle into neutral position.

23. Preparing of the control unit for operation and its maintenance is carried out in accordance with the instructions for their maintenance.

E. Starting
Drawing 35

24. Ascertainment of the fin extending possibility, determination of the fin tilting gears working conditions depending on the ship's speed and sea heaviness, as well as determination of starting sequence of the control units are carried out according to special instructions for stabiliser maintenance.

[illegible] the command to put the stabiliser into action [illegible] make sure that the tilting gear rams are

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Move the linkage handle controlling the extending control valve into the "EXTENDING" position and extend the arms, horizontally or extending at both sides to avoid the application of abnormal functioning. Making sure that the tilting gear pinions is engaged with the rack, return the handle to neutral position.

26. Set the pointer on the scale of the "Oil"-unit at the tilting angle which corresponds to the ship speed.(for each speed of the ship a maximum allowable tilting angle is indicated on the scale "A").

27. While starting the machinery make sure of proper functioning of the extending and housing gears, tilting gears and their control valves, hydraulic relay, accumulator, electric equipment, and control units.

To provide proper functioning of the machinery and filling of the system with oil, open slightly the valves on the sight glasses 579 of the tilting gears and of the hydraulic relay and work with opened valves for 2 - 3 minutes, then close the valves. With the machinery operating with opened valves be careful not to damage the sight glass.

28. Make sure that there is no oil leakage in glands and fittings of the pipe lines.

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[redacted] the agreement of indicator readings with [redacted]
[redacted] the signalling and locking system.

F. Maintenance during operation
Drawing 33

[redacted] Watch the machinery to work smoothly without shocks [redacted]
[redacted] unusual noise.

[redacted] Provide the greasing of machinery working surfaces [redacted]
[redacted] them and not allow their overheating. Watch the oil [redacted]
in the pump sump, not allowing its drop under the [redacted]
mark of oil level gauge.

[redacted] Check to the touch oil temperature in the pump sump [redacted]
tilting gear and by thermometers on the pipe line of [redacted]
hydraulic relay pump. Oil temperature in the drain pipe [redacted] of the gear pump at the oil cooler outlet should not exceed 45°C. In case the oil temperature drops in the drain pipe line of the tilting gear control valve under 30°C, the water supply into the oil cooler should be periodically cut off.

[redacted] Watch the water pressure in the [redacted] should not exceed 4 kgf/cm^2.

[redacted] Watch oil pressure by [redacted] operating there should [redacted] ing pipe line. [redacted] the fin extending pipe [redacted]

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In case this pressure rise exceeds 2 kgf/cm^2 some oil should be let out into the drain pipe line by opening the valves of the sight chests 6% of the extending and housing gears. But if oil pressure rises in the fin housing pipe line, then the valve 5% should be opened and some oil be let out into the drain pipe line. With systematic oil-pressure rise in the fin housing pipe line the valve 5% may be left slightly opened.

During the operation of the stabiliser it is allowable periodically to let out some oil via the valve 60.

17. Watch the signal lamps of the extending and housing gears with the ship's stabiliser operating "FIN EXTENDED" lamps should light.

18. Watch the temperature and the condition of the electric motors and electric equipment.

G. Shut down
Drawing 35

19. To shut down the stabiliser it is necessary to set the pointer "2" at zero on the scale "a" of the [illegible] handwheel; thereat the hydraulic relay and [illegible] should stop in neutral position.

20. After checking up by corresponding scales [illegible] gears rams and their control valves, the [illegible]

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ram of the hydraulic relay are in neutral position, move the handle controlling the fin extending and housing control valve 612 into the "HOUSING" position and then retract the fins. Non-simultaneous retracting of the fins does not mean the abnormal functioning.

39. Insert the stops holding the fin shafts with quadrants in the upper position.

40. In accordance with the Instructions for maintenance of the electric equipment switch off the electric motor of the MNR 0,14-4 pump.

41. Close the valve 771, open the valve 550 on the pipe line of the power cylinder, ascertaining that the excentricity of the MNR 0,14-4 pump is zero, switch off the motor of the hydraulic relay pump, open the valve 559. Switch-off the control units in accordance with the instructions for their maintenance.

42. Cut off current supply to the [illegible], signalling and blocking units.

43. Inspect the machinery outside and [illegible] damages, wipe the machinery and grease all [illegible] the supporting beam guides and sliding [illegible] be prepared to protect against [illegible]

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H. Particulars of care in different cases of machinery operation. Drawing 55

45. If only one board fin is to be lowered or raised it is necessary to close the valves 270 and 271, 600 and 602 on the pipe line of the fin extending [illegible] another fin.

46. If the pumps are damaged or [illegible] to the motors is ceased, the fin housing [illegible] accomplished by the hand emergency pump [illegible] position if they are out of this [illegible] with the fin lever. Thereon [illegible] against sliding back [illegible] position by the hand [illegible] the main pips line [illegible] in the direction to [illegible] the valves 618, 617, [illegible] aft, the starboard rod [illegible] move the rams in the upper [illegible] 615, 584, 578.

The setting of the fins into [illegible] pumps is allowed in emergency only [illegible] of tie-rods with springs 272.

When the rams are set into neutral position [illegible]

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on the hand pump pipe lines should be closed, and the valves
[illegible] and 605 be opened. The fins can be set into horizontal position by means of one pump or both pumps simultaneously.

48. To house the fins by means of the hand pumps proceed as follows:

a) Close the valves 608 and 610, and open the valves 600 and 601 on the hand pump pipe line, the valves 592, 593, [illegible] and 602 on the main pipe line being opened. Open the valves [illegible], 591 and 605 and retract both fins [illegible] simultaneously with the hand pumps.

b) With valves 599 and 602 [illegible] filling gear pipe line, or valves 592, 593 on the [illegible] filling gear pipe line closed each fin can be [illegible]

c) If one of the hand pumps [illegible] operation mentioned in clauses a) and b) [illegible] other one; for this purpose only the [illegible] the valves 589 or 603, then the [illegible], close the valves 600, 601, [illegible] valves 608 and 610 and leave [illegible] position.

48. To extend the fins [illegible] 608 and 610 and take out the [illegible] as previous, the [illegible] being opened. Open the [illegible] Close the valves 600 [illegible]

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operating simultaneously. Each fin can be extended separately Shut for this purpose close the valves 592 and 593, or 594 and 595 on the pipe line of the board with the unextended fin, as well as the valves 589 or 605.

I. Troubles and remedies
Drawing 55

a. In case of irregular movement of the hydraulic relay ram or of the tilting gear ram open the corresponding valves at the right sheets and release air. After the ram moves in a steady smooth close these valves.

b. If pressure in the pipe lines exceeds the relief valve adjustment pressure, dismantle these valves and eliminate the trouble.

c. If the pressure in the tilting gear drain pipe line exceeds 2 kgf/cm^2, open the valve 549, close the valves 542 and 552, remove the filter 515 and clean the filter disks and sleeves. After cleaning assemble filter, open valves 542 and 552 and close the valve 549.

d. If the pressure ahead of the filter 576 exceeds 2 kgf/cm^2, open the valve 583, close the valves 575 and 584 and clean the filter. After cleaning assemble the filter and open the valves 575 and 584, then close the valve 583.

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53. If, with the tilting gear rams in neutral position, the linkage handle controlling the fin extending and housing control valve cannot be changed-over, check up the adjustment and proper condition of the blocking units and of the "O"-rings; check up if there is voltage in the blocking circuit.

54. If the tilting gear control valves do not move freely, check up if there is oil in the damper cylinders and flush them if necessary.

55. In case of oil leakage in pipe and valve joints, tighten them; if it does not help dismantle them and change the gaskets.

56. Compressing of tie-rods with springs of linkages of the tilting gear control valve and hydraulic relay at stabilizer operating may be due to jamming of rotating joints of linkages and control valves. In this case shut down the stabilizer, inspect all the assemblies and eliminate troubles.

57. In case of oil leakage through stuffing boxes of the extending and housing gears control valves, tighten up the glands. If leakage cannot be eliminated by this measure, [illegible]

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sight sheets 613 of the extending and housing gears, and maintain pressure up to 2 kgf/cm^2 in the extending space of the cylinder.

If voltage is not supplied to the control units with pump motors energized, shut-down the stabiliser and set the pointer of the scale of "OK"-unit at zero (scale "4"); after voltage recovery switch-in the control units in accordance with the Instructions for maintenance of control units.

In case of pump motors and control units deenergizing shut-down the stabiliser, switch-off the motors and control units. Supply current from the other board feeder and switch-in the control units. Close the valve 571, open the valve 560 and switch-in the motor of the gear pump 585. Open the by-pass valve 559. In accordance with the Instructions for maintenance of the electric equipment switch-in the motor of the MBN Q14-4 pump and in parallel with speed close the valve 559; thereat the tilting gear must be set in neutral position. Commence opening of the pump valve and switch the load into the hydraulic unit. Switch-off the gear pump motor.

In case of full loss of current supply, to shut down the stabiliser, switch off the control units, set the "OK"-units of the [illegible], change-over the valves on the hand pump pipe lines according to the clauses 46 and 47 of these Instructions and restart

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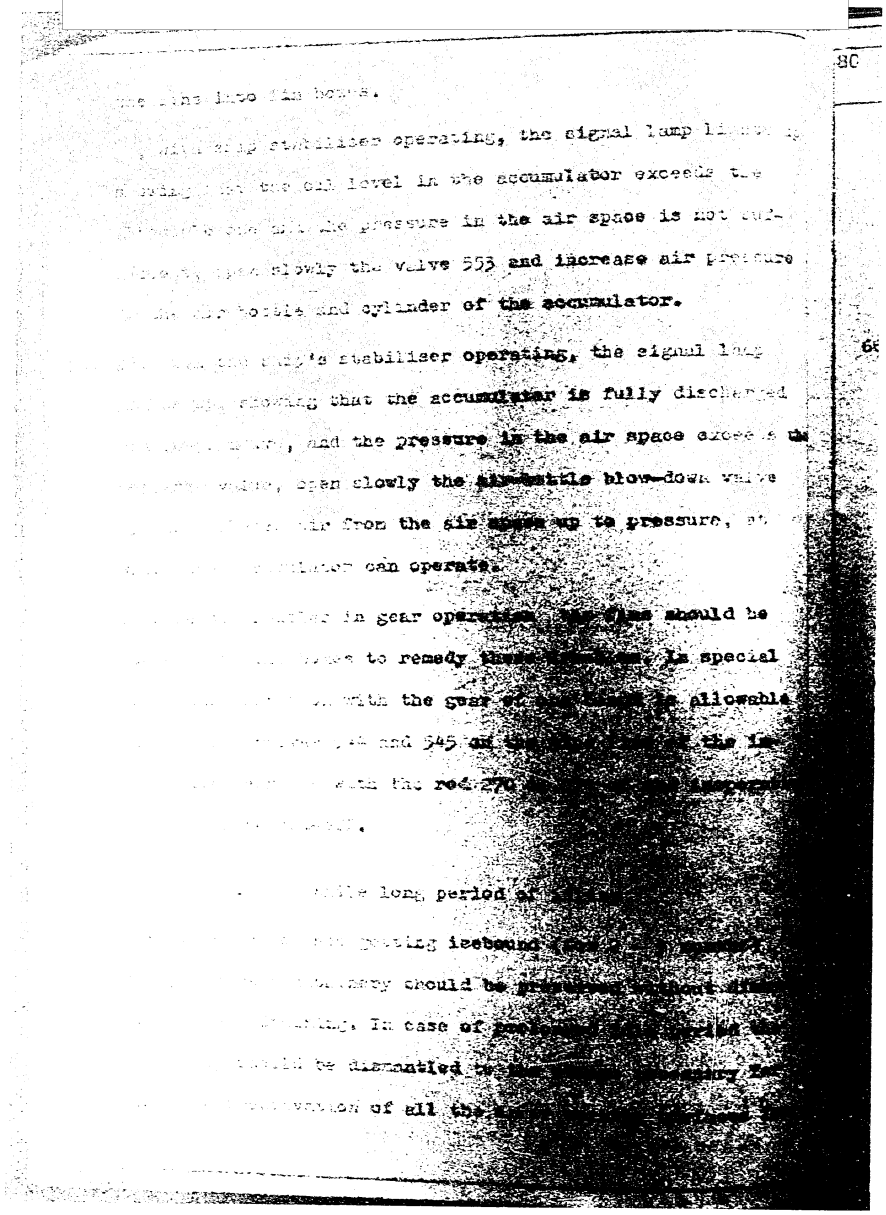

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a long time preserved machinery should be inspected periodically (once in four months) to check the preservation condition. Grease should be renewed if necessary.

b. Dismantling

While repairing and inspecting dismantle the machinery to the extent necessary to eliminate troubles or to meet the certificate requirements. Do not dismantle machinery operating properly without necessity!

Preservation is to be done according to subsection "F" of these Instructions. Dismantling and assembling of the machinery should be accomplished by means of common tools, special wrenches (spanners) and special devices.

57. Wash all the dismantled parts [illegible] and thoroughly wipe them out. All the machined [illegible] be immediately greased.

58. While dismantling all the [illegible] placed on wooden boards or [illegible] mounting and storage [illegible] and d.l.w.s pump, [illegible] steering gear control [illegible] rotary control [illegible] starting [illegible]

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69. While dismantling mark the parts to avoid wrong assembling. Marking should not damage the working surfaces of the parts.

70. While dismantling and assembling measure dimensions and clearances of parts in accordance with the certificate.

71. While dismantling examine each part and in case of its damage replace damaged parts or replace them by the spare ones from the spare parts set listed in the certificate.

72. While dismantling and assembling of assemblies and units of machinery it is necessary to follow all the technical requirements stated in the operating instructions of assemblies and units.

73. Before dismantling of the [illegible] unit, control valve and all the [illegible] mutual position of their bodies and [illegible] The required mounting forces of the [illegible]

74. All the dowel bolts [illegible] the bed plate as well as all the [illegible] machinery should be marked for [illegible]

75. After dismantling [illegible] the shape, by means [illegible] fittings and [illegible] avoid scoring [illegible]

76. Before assembling [illegible] with kerosene [illegible]

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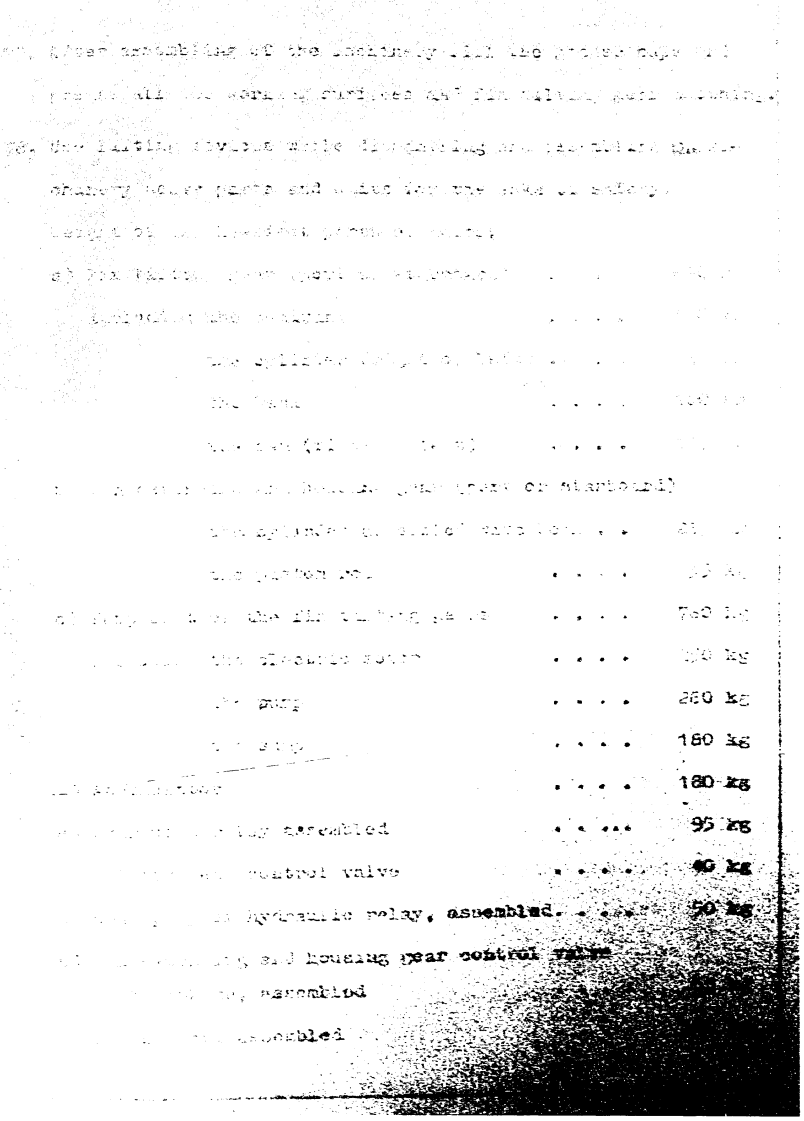

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[redacted]

k) oil tank

99. All the data about dismantling [redacted] checking, all the troubles found out, [redacted] worn or damaged parts with the spare ones, [redacted] checking up of clearances, and prescriptions are to be recorded in the certificate.

Dismantling of power drive machinery

[redacted] complete dismantling of the power drive machinery [redacted] given below. In other cases (e.g. at the scheduled [redacted] inspections at unsatisfactory operation of [redacted] while changing the worn parts with spare ones, [redacted] should be dismantled only to the necessary [redacted] complete dismantling of the whole unit [redacted] only operating power drive machinery [redacted] not recommended.

[redacted] sure that the fins are housed into [redacted] are locked by inserted stops.

[redacted] from the ship's air pipe line and [redacted] of the bottle and [redacted] the fin extending [redacted] cylinders, tilting [redacted] accumulator, variable [redacted] oil cooler.

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[redacted]

First of all remove the "MY-1"-unit and "[illegible]"-unit according to the instructions for their maintenance. Then remove the [illegible] and blocking devices, [illegible] with their pipes, thermometers, oil-[illegible] sheets for air releasing.

Disconnect pipe lines from the [illegible]

Disjoint the linkage of the filling [illegible]

Disconnect the rotating connections [illegible]

the rods 269, 270, 271, 272, 274, and [illegible]

rods into rod forks are fix by nuts, [illegible]

to disconnect the rods themselves to [illegible]

[illegible] remove the balancing head, [illegible]

[illegible] with angle levers, without [illegible]

[illegible] and remove from the ship [illegible]

[illegible] valves, hand pumps, the [illegible]

[illegible] of control units, [illegible]

[illegible] control valves with [illegible]

[illegible] relay pump-unit.

The sequence of removing and dismantling [illegible] assemblies is to be established [illegible] considering the convenience of performance [illegible] machinery room.

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80

tilting gear pump-unit from the ship's stru

extending and housing gears and tilting gear

structure and remove them.

of damage of the protecting varnish-paint cover on

pumps and joint connections of the pipe lines

or dismantling, paint these spots with rust

Dismantling of main assemblies

fin extending and housing gear

drawing 4

of the fin extending and housing gear is

the following way:

in dock and no water in fin boxes.

nuts of the cylinders 25, disconnect the

and bracket, pull out the axle 19.

in the fin box bottom. Push in the

axis till the rod will be fully

a little the quadrant from the

gears and lock it in this position.

the supporting beams to the ship's

supporting beams together with the cy

the nut and take off the quadrant

further dismantling is not difficult.

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Gear cylinders can be taken off after disconnecting them from the supporting beams without removing the latter from the ship's structure.

90. Dismantling of fin extending and housing gears with ship afloat. Move the fin shaft into the lower position. Remove the upper cover (1) of the fin extending and housing gear cylinder. Disconnect the cylinder from the supporting beam, unscrew the bolts fastening the cylinder to the cover (1). Move the cylinder along the rods and take it off from the piston. Further dismantling is simple.

Fin tilting gear
Drawing 5

91. To dismantle the fin tilting gear removed from the ship's structure, proceed as follows:

Disconnect the beam 82 from the cylinders 62 and 72; unscrew the nuts from the rods 58 and 67, loosen the stuffing boxes. Moving the cylinders apart, take them off from the rods.

[illegible] is not difficult.

Pump unit
Drawing 6

[illegible] unit control valve [illegible]

[illegible] nuts of the half-[illegible]

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side and remove the studs together with dampers. Remove the motor from the pump together with half-coupling. Remove the pump [illegible] from the pump.

Variable Delivery MVH 0;14-4 pump
Drawings 7 and 8

To dismantle the MVH 0;14-4 pump proceed as follows:

Unscrew the nuts and remove the gear pump [illegible] Unscrew the nuts and remove the brackets with cylinder [illegible] with eccentricity pointer 142 being [illegible] Unscrew the stop-screw in the half-coupling [illegible] from the pump driving shaft.

Remove the right ball bearing cover 145 of the [illegible] Unscrew the ring nut which fastens the ball bearing [illegible] from the casing and withdraw the driving [illegible] ball bearings. Unscrew the screw fastening the [illegible] of the bearing 117. Prop up the floating ring 114, unscrew the screws fastening the front slide 119 and rear slide [illegible] and remove the front slide 119 together with the ball bearing 117 and stop ring. Remove the driving shaft 124 [illegible]

The rear slide, ring 114 together with covers, rotor [illegible] pump from the casing. While removing the flow [illegible] it will be out of [illegible] with the [illegible] 102 with the [illegible]

[illegible] of the slide walls of the [illegible]

Over

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screws and remove the flanges with the cut piece 154, then remove the rear slide 153.

Further dismantling of the [illegible] is not difficult.

NOTE: 1. While dismantling check up the [illegible] marks on the housing, ring, cut and other, coupling, piston and piston bearing, etc.

2. Dismantle as much oil [illegible] as possible, but avoid unnecessary, such [illegible] and [illegible].

Inspect all of the parts of the [illegible] difficulties.

[illegible] of [illegible]
Drawing 10

94. Remove cover 1, release [illegible] piston accumulator to the shaft [illegible] from the [illegible] and switches from the [illegible] valve, [illegible] the [illegible] and lower covers 135 and 136, [illegible] the cylinder and dismantle it if necessary. While dismantling fix the position of gaskets and [illegible] relative to the piston, as well as of the [illegible], and relative to the covers by marking.

[illegible] control valve
Drawing 11

95. Remove the cut 204, after marking its position on the rod.

Put marks on the cover 207, control valve casing 208, and

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on the flanges of the damper body 215. Unscrew the [illegible] and remove the damper body 215 together with the cover, damper rod 216, and spool 211.

Further dismantling is simple. The screw fastening the captive nut 213 to the damper rod may be unscrewed only in case of extreme necessity.

Hydraulic relay
Drawing 13

96. Remove the ear 257 marking its position on the [illegible] on the covers and casing. Remove the covers 242 and [illegible] spool rod being shifted into the limit right-hand [illegible]. Extract the ram assembled with the spool from the [illegible] relay casing. Dismantle the covers of the hydraulic [illegible] casing. Unscrew the locking nut 257 and the ear 258, marking its position on the ram and pull out the spool rod in the left-hand direction.

Linkage for tilting gear control valves
Drawing 14

97. Dismantling of the linkage can be done partially by removing only the hydraulic assemblies from [illegible] and plates. Dismantle the ends of the linkage [illegible] to avoid

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from the [illegible] pump, remove the spring [illegible] and remove the [illegible].

98. Disconnection of the [illegible] between the hydraulic relay and [illegible] in the same way as that of the [illegible].

[illegible]

99. Remove the [illegible] on the [illegible] bolts fastening the [illegible] pump 284 to the [illegible] plate 280, knock out the taper pins, turn the pump to the left until the motor half-coupling will be out of studs and remove the pump. Then remove the motor. Put mating marks on the gear casing 280, spacers 285 and 287 and cover 286. Then untie the pump. Take dowel bolts.

NOTE: Dismantling of the rest machinery units which are not mentioned in this process is not difficult and does not require explanations.

5. Assembling

Assembling of separate units should be carried out in accordance with the drawings and with consideration of mating marks on the parts. While assembling, meet all the technical requirements in assembly drawings. All the parts to be assembled should be lubricated with a thin film of hydraulic

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oil. While assembling the units mentioned below it is [illegible]
ry to follow the following instructions also.

Pin tilting gear

Drawing 5

100. Fix the bracket 59 on the ram 73, set on both sides [illegible]
the flanges 68, glands 69, and packing rings [illegible]
rod piece 57 with the guide rod 58 in the bracket.
the rods 56, 67, the ram 73 and gear cylinder [illegible]
fix the nuts on the rods by lock-nuts. Fasten [illegible]
cylinders to the beam 82. Fasten the bracket [illegible]
rack 52 on the ram. Fasten the pointer 54 [illegible]

Pump unit

Drawings 6, 7, 8, 9.

101. Insert the trunnion 104 into the pump casing, [illegible]
with nut 102, and mount the casing in such a way [illegible]
trunnion would be in vertical position.
Mount the rear slide 105 together with the ball bearing 107
and stop plate in the casing. Mount the floating ring 114
assembled with the rotor, pistons, and other parts, the
rear cover 111 being mounted on the bearing 107 and on
rotor with the bush 108 fixed [illegible] trunnion.
Mount the [illegible] 124 and the
[illegible] and support
[illegible] ram the
[illegible] bearing
[illegible]

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bearing 120 on the driving shaft, fix it with a nut and close by cover 123. Mount the gear pump. Via the slide holes in the casing fix the slide flanges with the connecting piece 124 and mount the brackets with cylinders 127, 129. Engage the pump tip eccentricity point into zero position corresponding to the neutral position of the filling part of the pump. Connect the casing the pump with the motor shaft by means of the half-couplings. Angular and lateral shaft misalignment within value indicated in the specification.

While assembling the regulating unit control valve it is necessary to provide the mounting height of the spring by screwing-in the socket up to the depth marked on the drawing (see drawing 9).

Final adjustment of the gear pump relief valve and regulating unit control valve 93 should be accomplished with the pump operating at the pressure in the pipe line of the gear pump of $3,5^{+0,5}$ kgf/cm^2, and of the NP 0,14-4 pump - 57 kgf/cm^2.

Accumulator
Drawing 10

The piston with clearance of 0,5 mm between the ring groove 169 and the lip-seal 171, leaves the piston

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the pipes connecting the oil and air chambers of the cylinder with the head 181.

Fan tilting gear control valve
Drawing 11

103. Assemble the spool rod with the spool 211 and secure [illegible] the nut 212. The mode of securing the spool on the rod must provide selfalignment of the spool with minimal [illegible] ances. Connect the spool rod with the damper rod and [illegible] them in the control valve casing. Mount the damper [illegible] lates 217, and cover 220, put the cover 207 and [illegible] tightening the nuts check up the smoothness of [illegible] when screwing gradually the nuts provide smooth [illegible] less movement of the rod along the bush axes. After [illegible] ing of the control valve the rod moving force should not exceed 1,5 kgf/cm^2.

Hydraulic relay
Drawing 13

104. Assemble the spool rod 238 with the spool 246 and secure [illegible] with nut; provide the selfalignment of the spool with minimal axial clearance. After assembling check up the smoothness of the spool movement to the right and to the left up to refusal. Mount the ram assembled with the rod in the hydraulic relay casing and secure the cover 242. Set the cover 264 in accordance with setting marks and before [illegible] with nuts, [illegible] Then, [illegible] and jamming [illegible] filling of the

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[redacted] relay the rod moving force should not exceed ½ kgf/cm². Assemble the cover sealing and mount the gland. [redacted] the cams 27a and 28a and lock them with nuts.

Electric gear pump
Drawing [redacted]

[redacted] the pump and, turning it over by hand by the drive coupling, check up the smooth rotation of the plungers. Install the pump on the sump and insert the taper pins. Mount the cover on the sump and check up the alignment of the drive couplings. Lateral and angular misalignment of the pump and motor should be within values in Drawing [redacted]. Fasten the motor on the sump. Connect both half-couplings by studs and mount the housing.

Final assembling of the power drive machinery
Drawings 1, 2, 3, 4

[redacted] the sliding gears on the ship's structure and

[redacted] thrust rings 42, packing rings 41, and [redacted] the pistons assembled with rods

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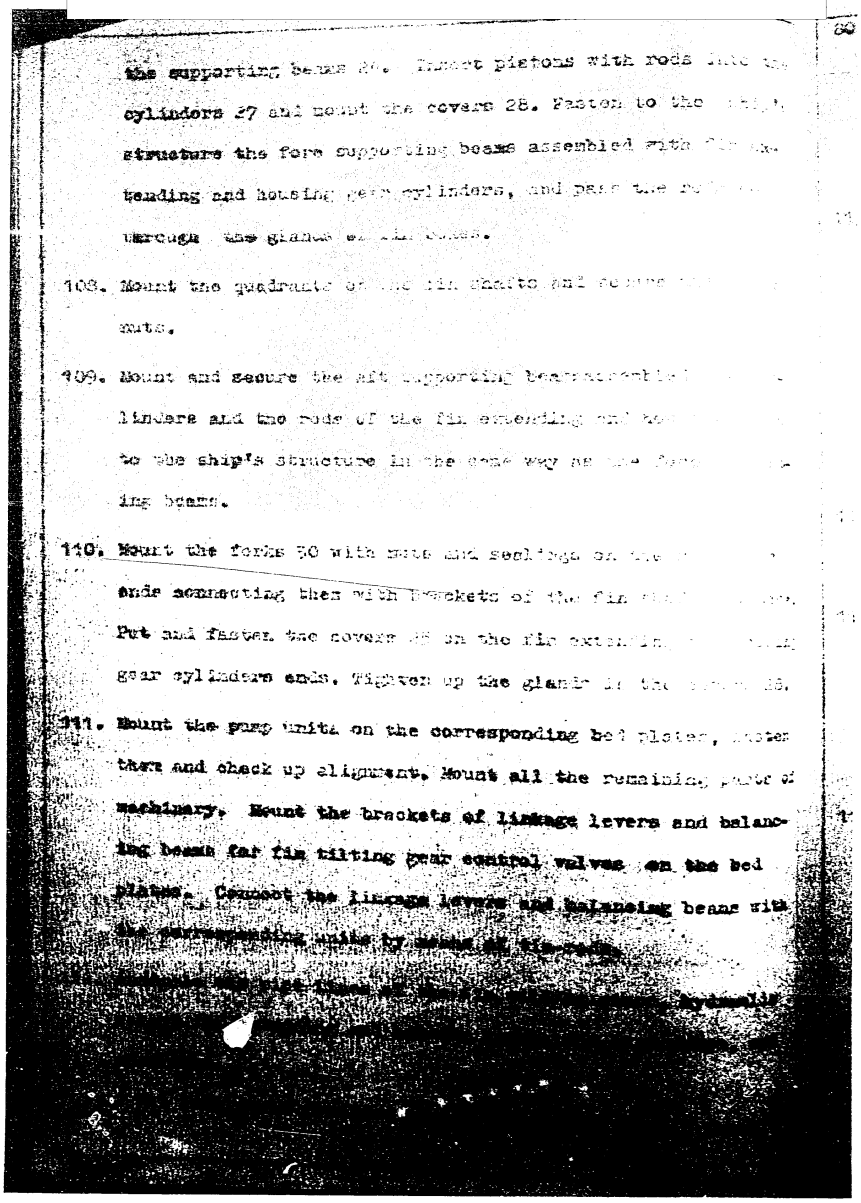

the supporting beams 26. Insert pistons with rods into the cylinders 27 and mount the covers 28. Fasten to the ship's structure the fore supporting beams assembled with fin extending and hoisting gear cylinders, and pass the rods through the glands within covers.

108. Mount the quadrants on the fin shafts and secure with nuts.

109. Mount and secure the aft supporting beams assembled with cylinders and the rods of the fin extending and hoisting gear to the ship's structure in the same way as the fore supporting beams.

110. Mount the forks 30 with nuts and sealings on the ends connecting them with brackets of the fin shafts. Put and fasten the covers 29 on the fin extending and hoisting gear cylinders ends. Tighten up the glands in the covers 28.

111. Mount the pump units on the corresponding bed plates, fasten them and check up alignment. Mount all the remaining parts of machinery. Mount the brackets of linkage levers and balancing beams for fin tilting gear control valves on the bed plates. Connect the linkage levers and balancing beams with the corresponding units by means of pipes.

Assembling

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...ntrol units, indicators, signalling and locking ...
... sight checks on the corresponding places.

...embling charts, ... from operation ... for ...
... of power drive machinery in accordance with ...
... A, B, C, D, E, and ... of these Instructions ...

...ust and test the ... machinery ... with the ship sailing.

E. Preservation.

...oil from all the machinery ... and pipe ...
... openings of all the connections with metal ...
... and flanges.

...servation should be accomplished in a dry room ...
... not under +10°C. Surface temperature of the ... to be preserved should be the same as that of the ambient ... in the room. Surfaces prepared for preservation should ... clean and dry, without traces of corrosion, dust, and oil ...

...ter and machined inner surfaces of machinery ... be greased with grease UR 3 according to ... The ... of grease film should be 0,1-0,2 mm. To prevent ... of the grease film all the preserved surfaces ... covered with waterproof paper treated with ...

... less than ... ...

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118. Preserve hand pumps, electric motors and control [illegible] accordance with corresponding instructions for maintenance of this equipment.

H. Recommissioning

119. To prepare the machinery for operation after [illegible] is necessary to remove grease from all the [illegible] dismantling the assemblies to the necessary extent, [illegible] out thoroughly all the machinery parts.

120. Examine thoroughly all the machinery. Remove [illegible] from all the bearings and grease cups, wash them [illegible] sary and fill with fresh grease.

After recommissioning charge the power drive machinery, prepare it for operation and carry out test startup according to subsections A, B, C, D, E, and F of these instructions for maintenance.

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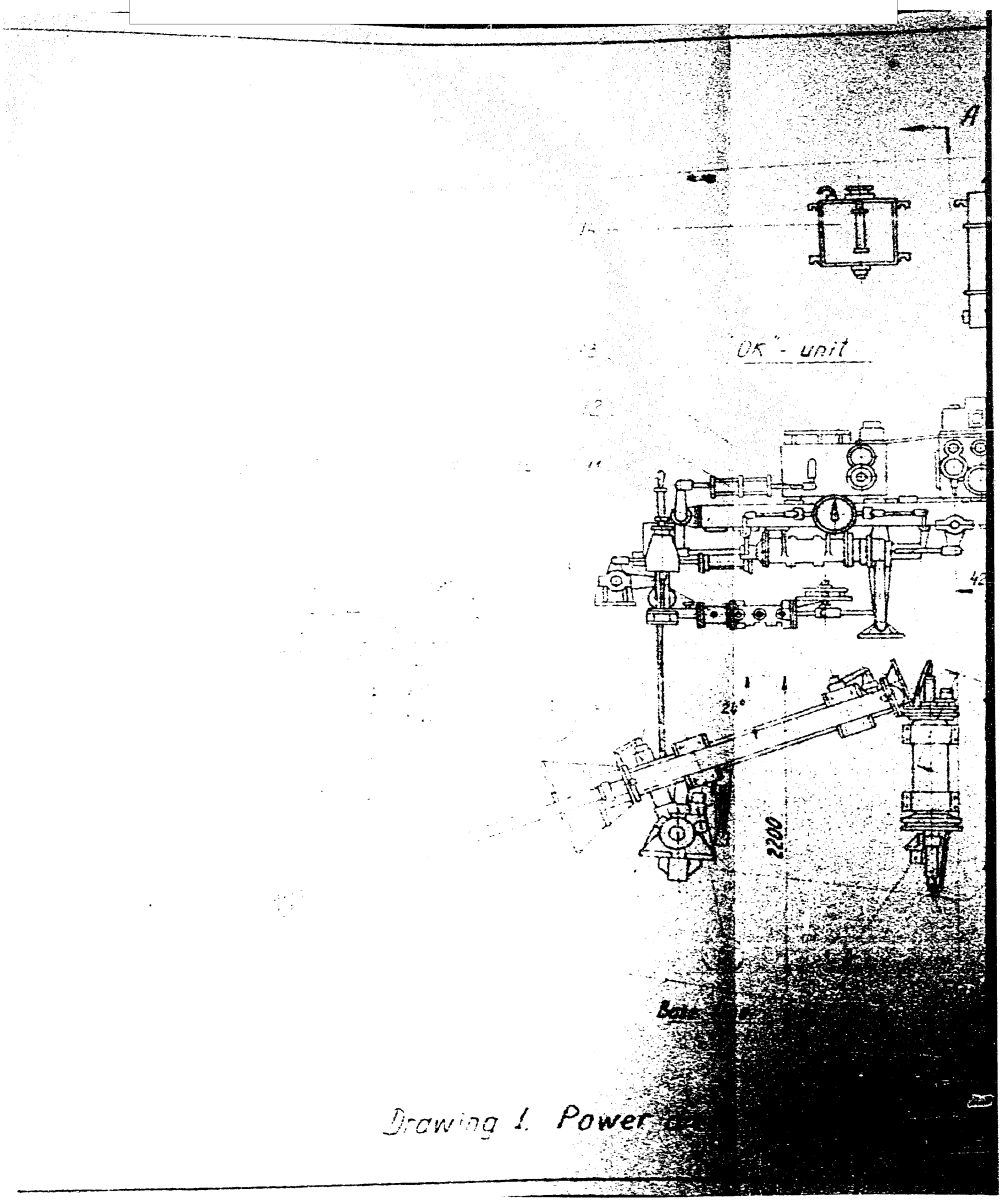

Drawing 1. Power

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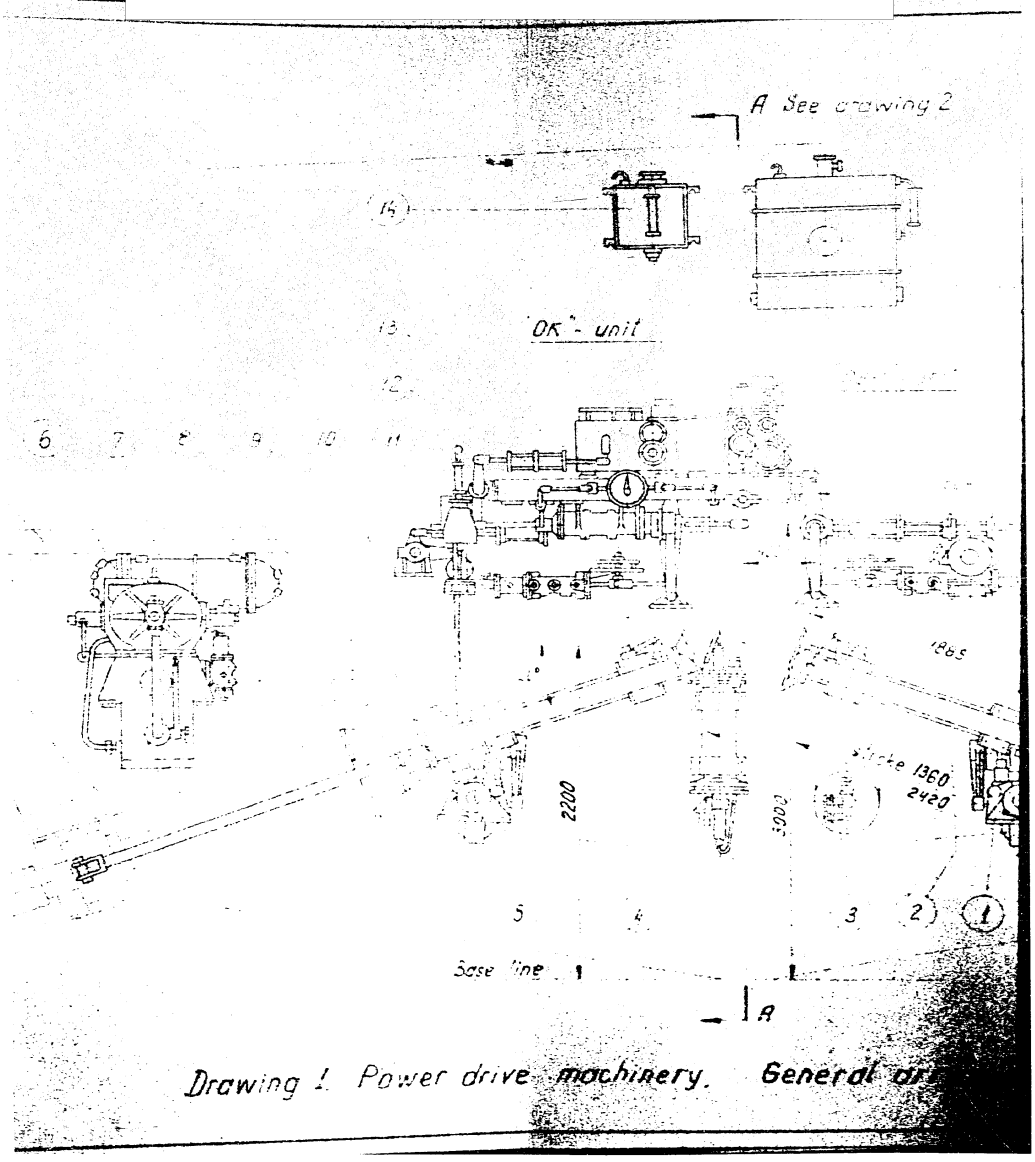

Drawing 1. Power drive machinery. General ar

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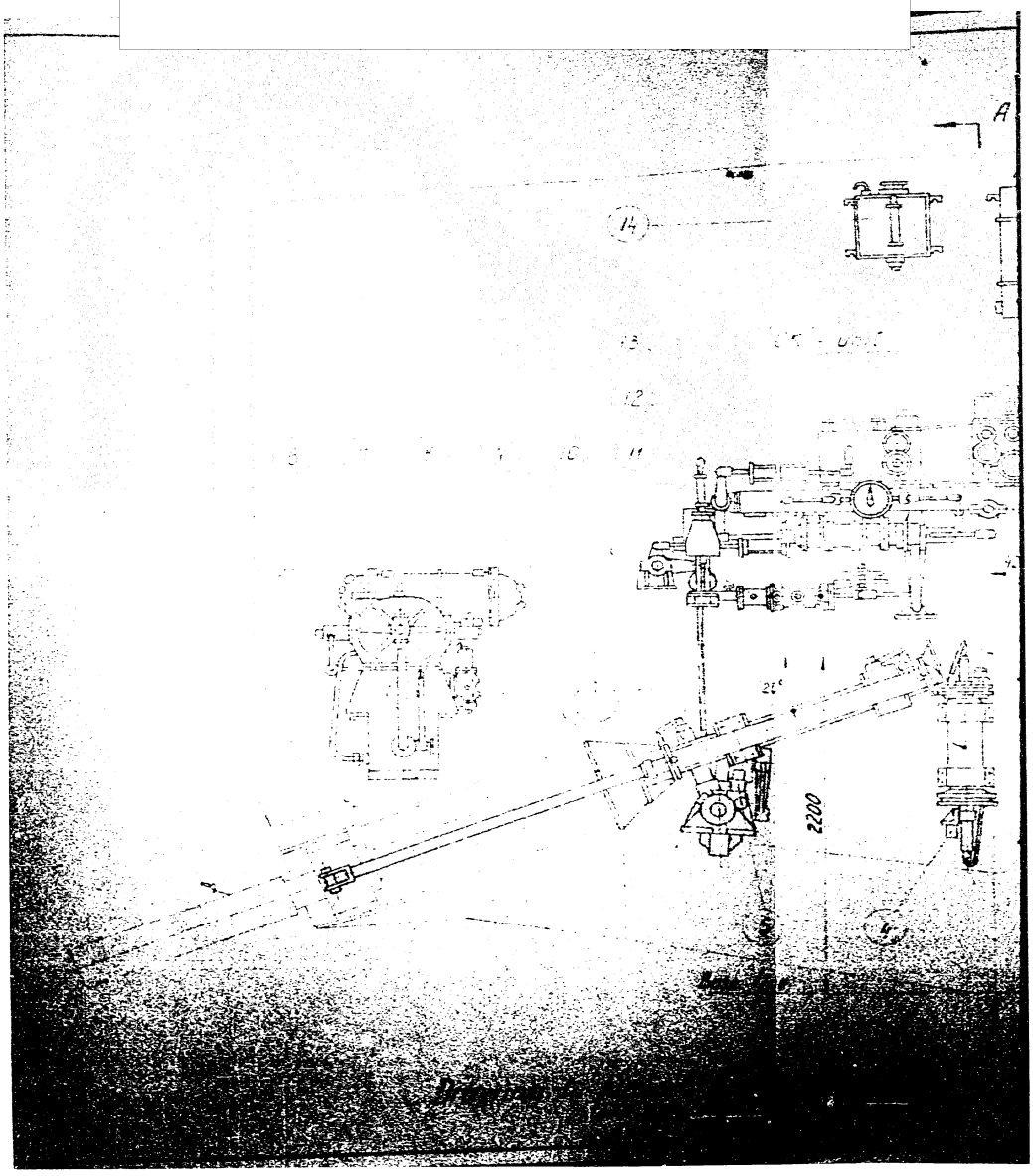

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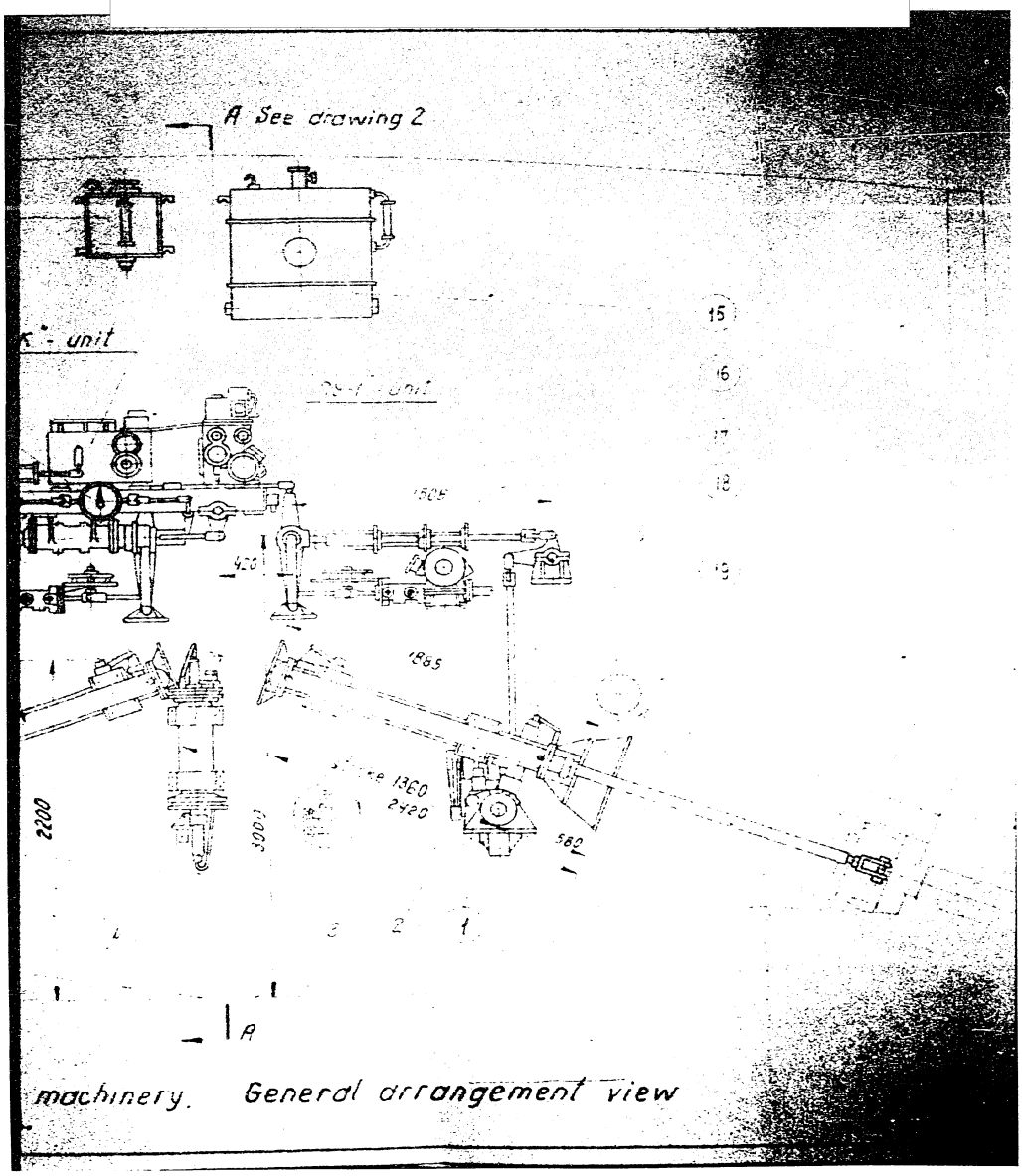

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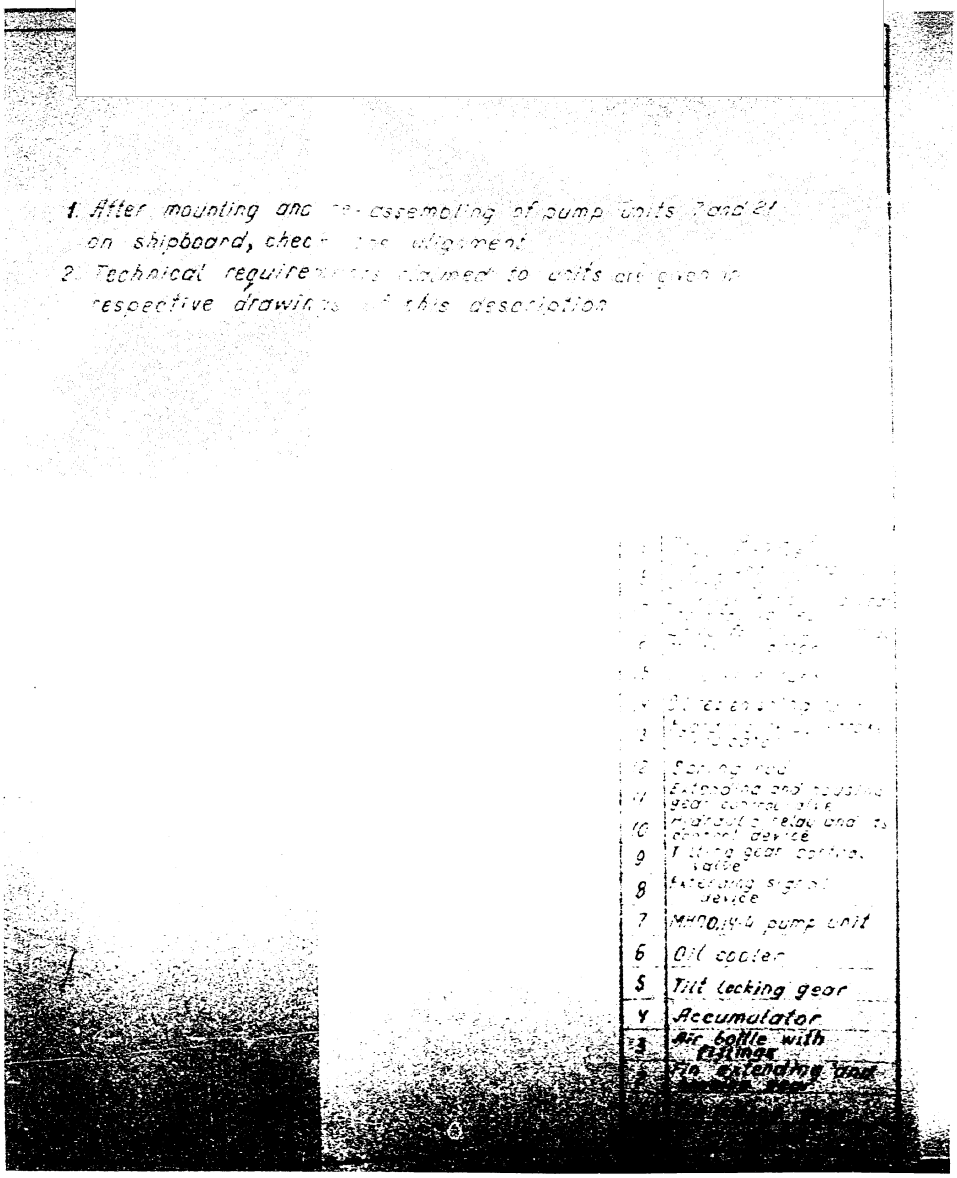
1. After mounting and re-assembling of pump units 7 and 21 on shipboard, check the alignment
2. Technical requirements assumed to units are given in respective drawings of this description



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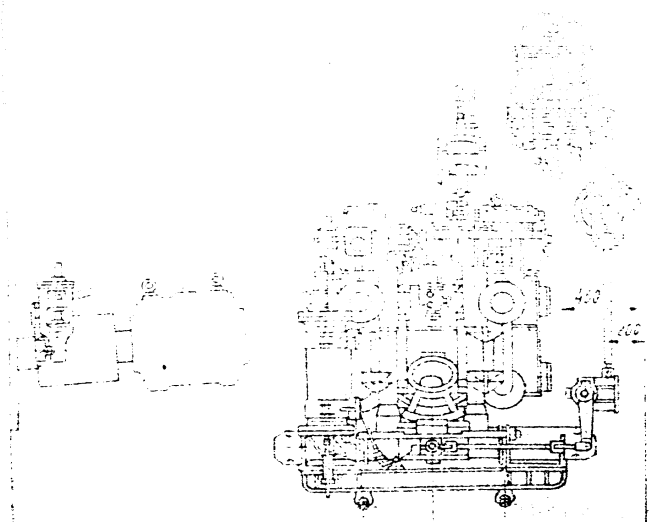
F 9

See drawing 1



Drawing 2. Power drive machinery [illegible]

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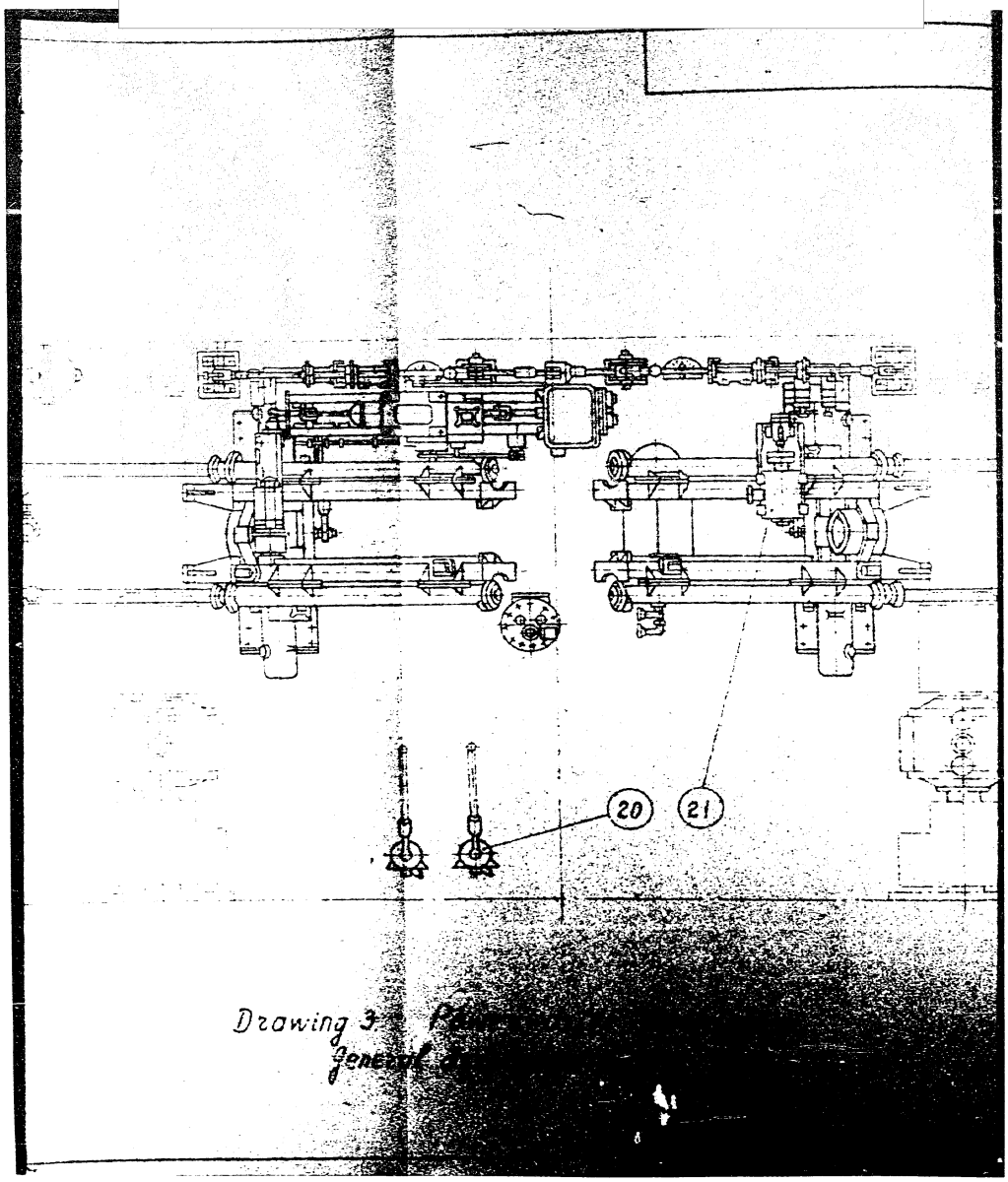

Drawing 3 [illegible]
General [illegible]

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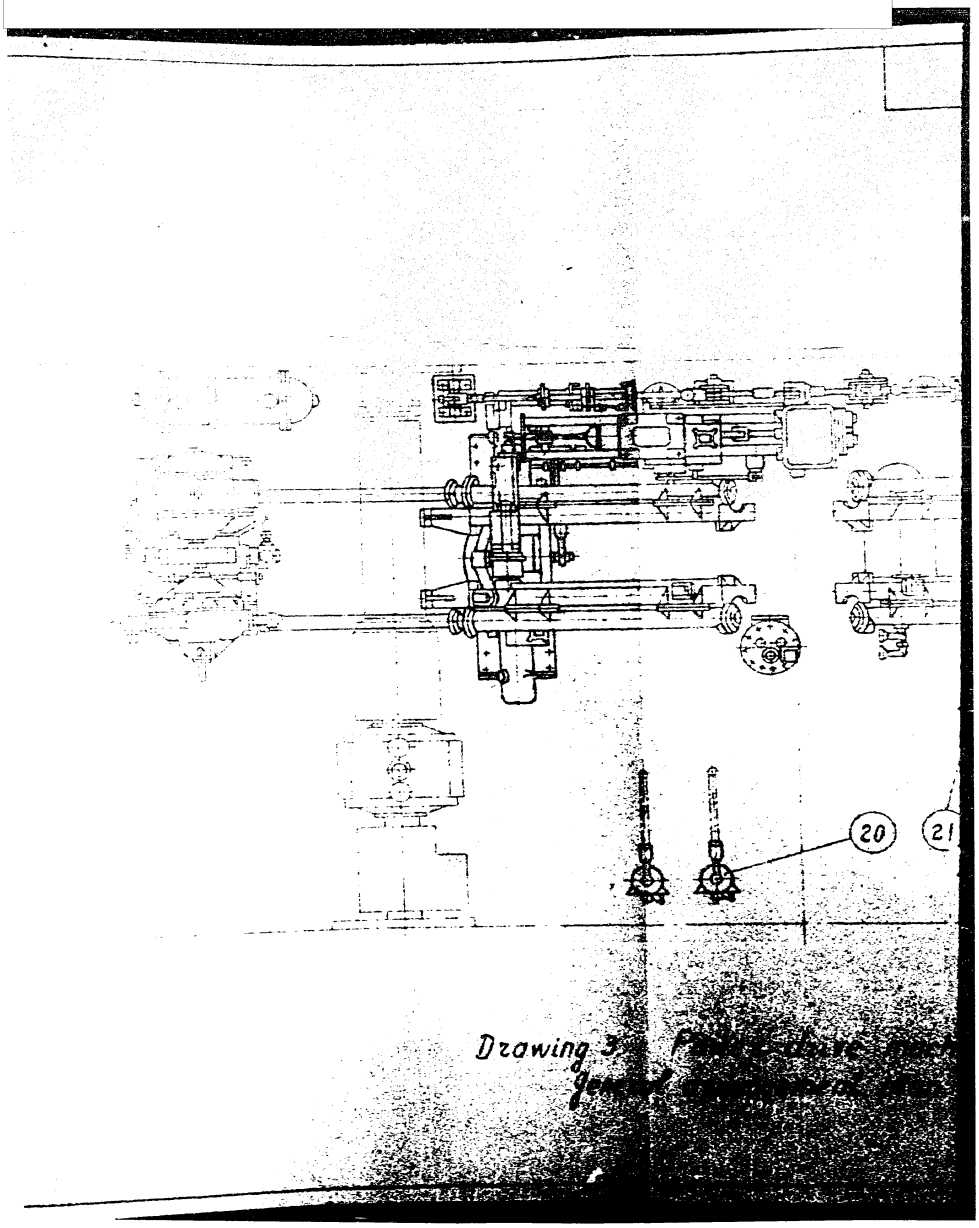

Drawing 3

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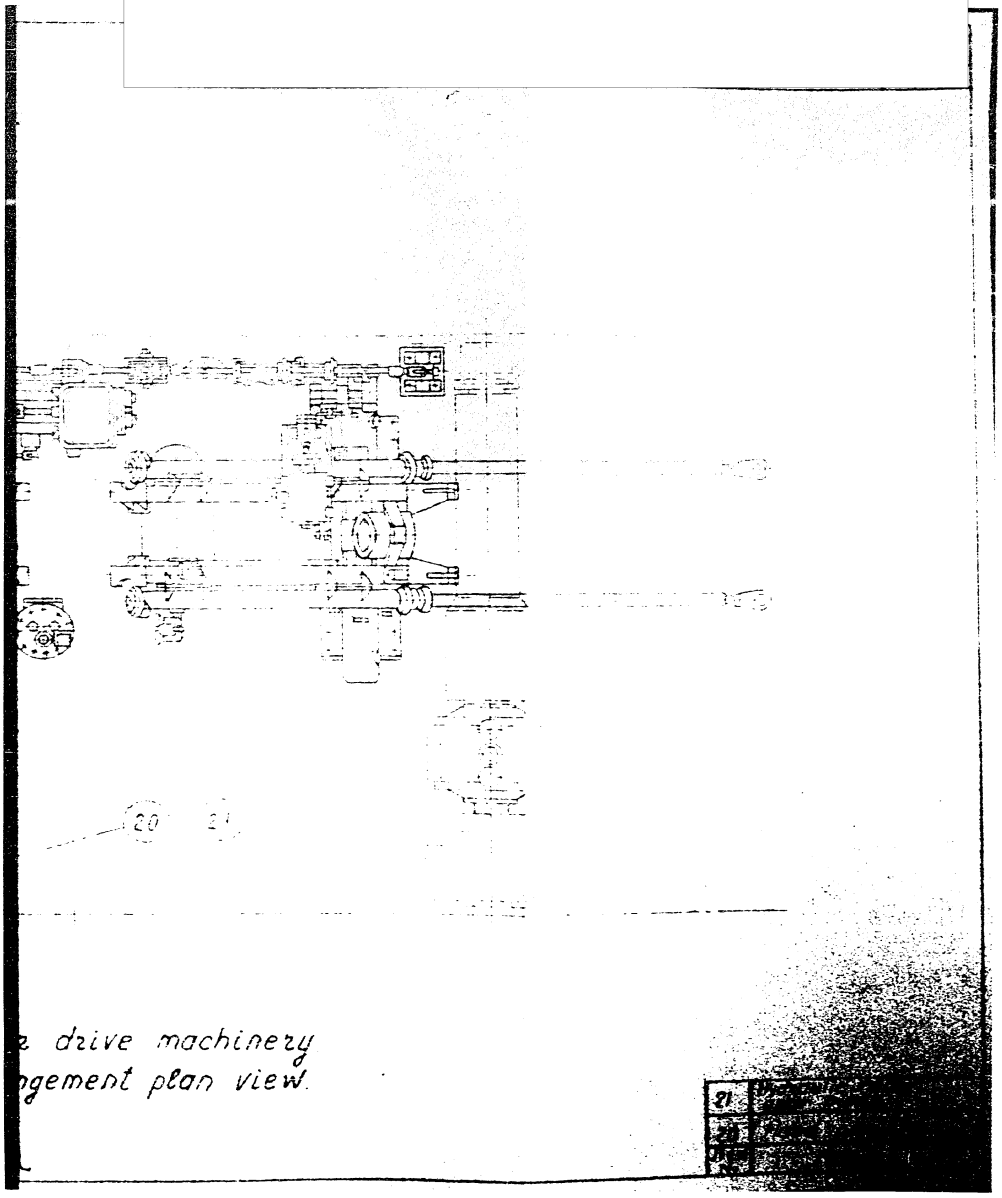

drive machinery
gement plan view.

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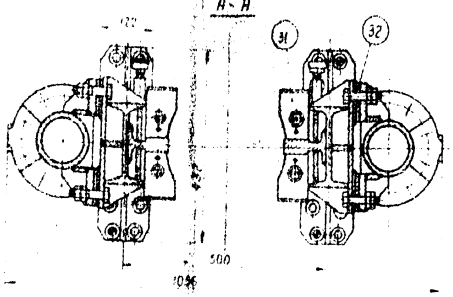

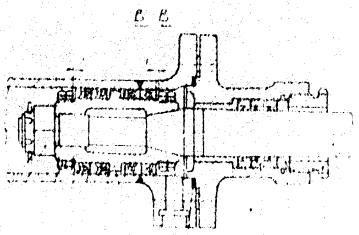

Technical requirements

1 Lateral misalignment of centres of the supporting beam axes must not exceed 0.1 mm.

2 Bearing beam plate surfaces E should be in one plane. Allowable out of planeness within 0.03mm. Allowable out of perpendicularity of planes E relative to guides within 0.04 250

3 Clearance between nut 35 and lip seal retainer 36 is provided by shims 38

40	Body
39	Piston
38	Shim
37	Lip seal
36	Lip seal retainer
35	Nut
34	Nut
33	Collet pin
32	Shim
31	Plate
30	Fork
29	Axle
28	Cylinder cover with gland
27	Cylinder
26	Stop
25	Cylinder cover
24	Supporting beam
Pos.	Name

Drawing 4 Pin extending and housing gear

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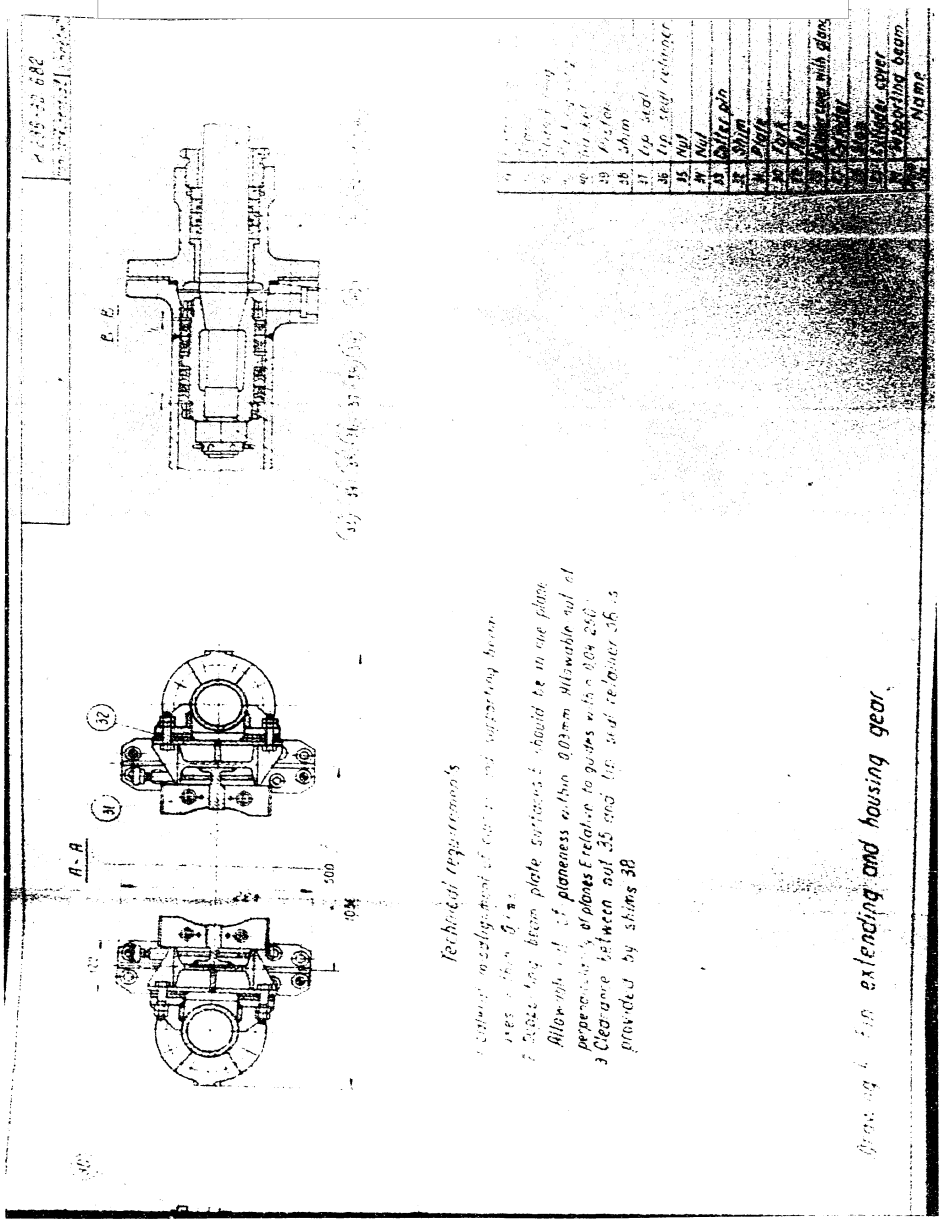

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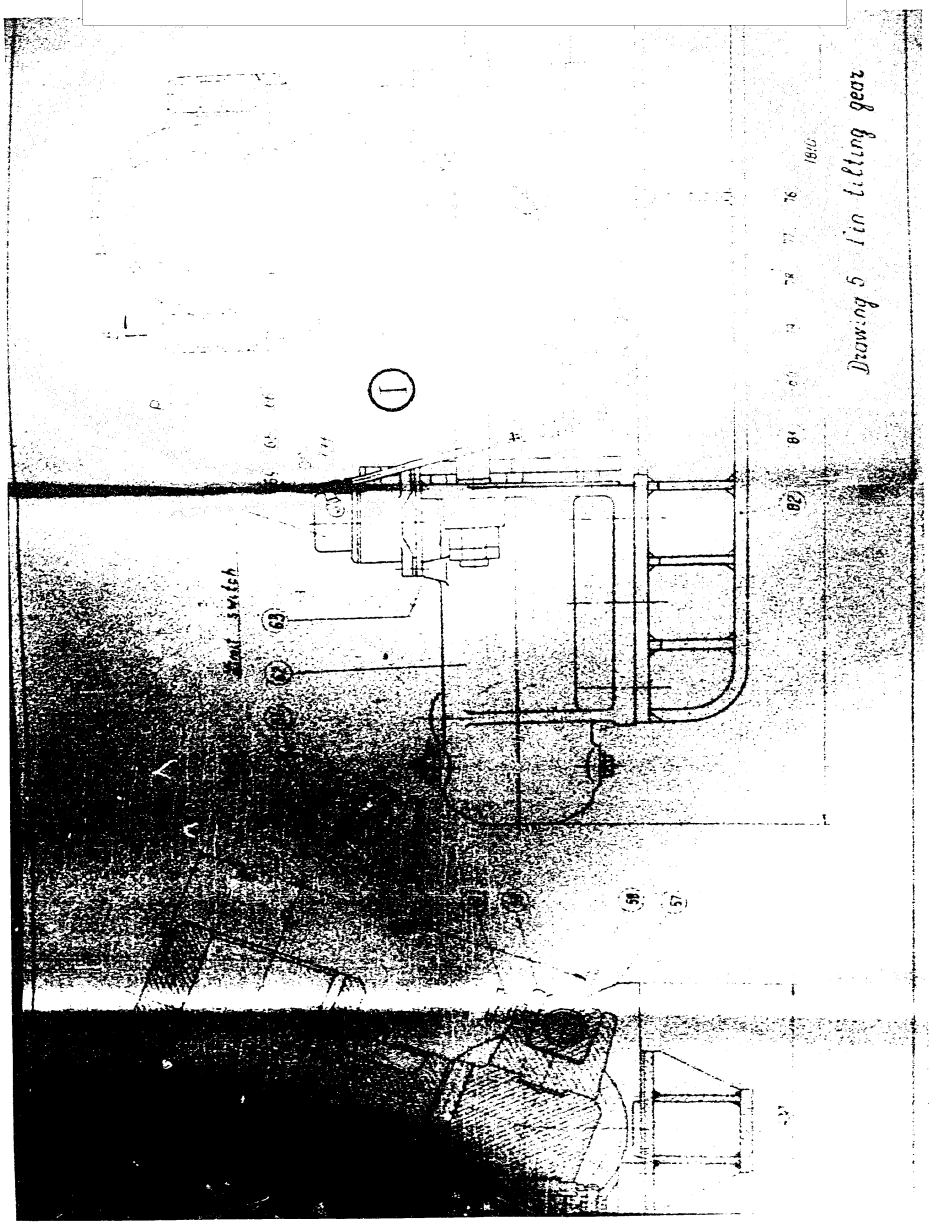

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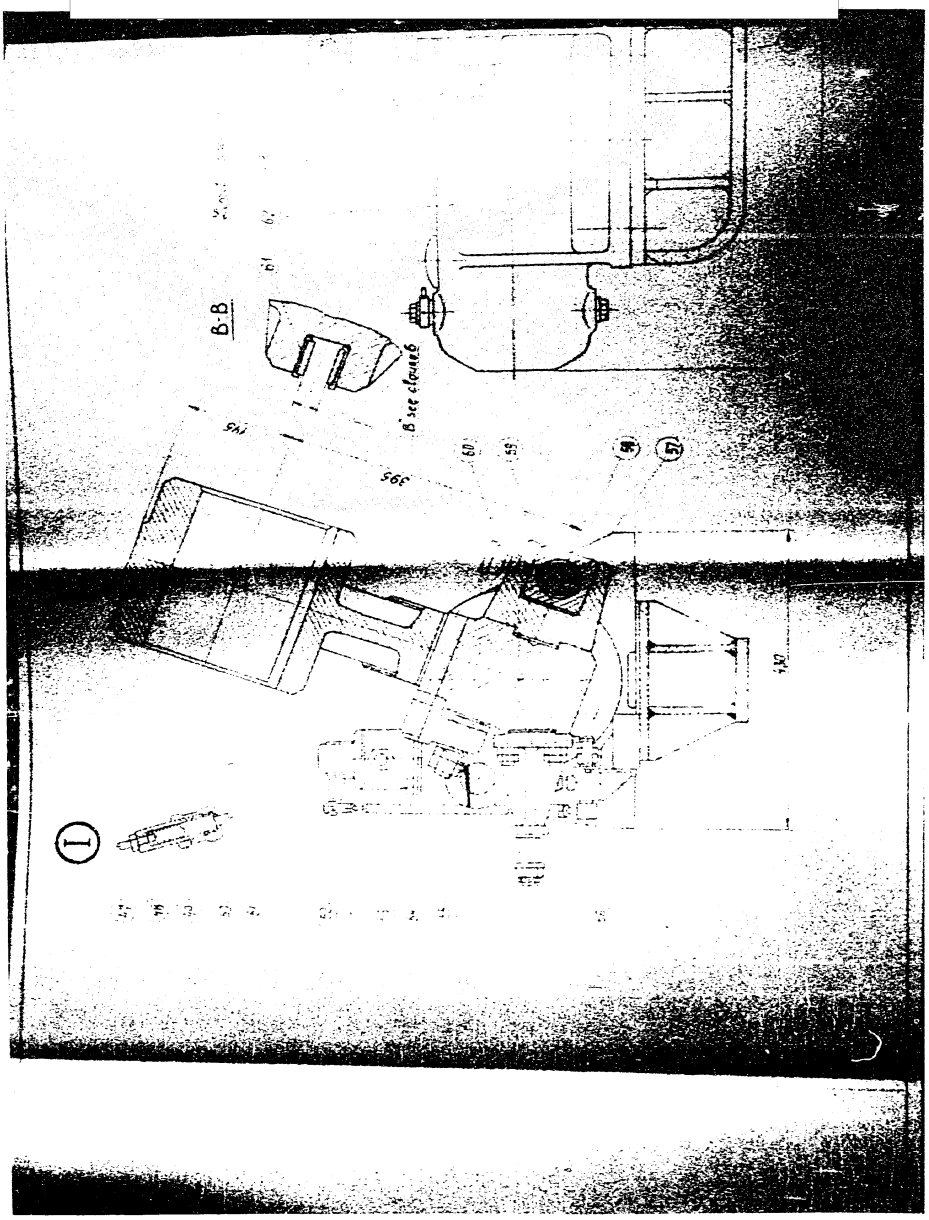

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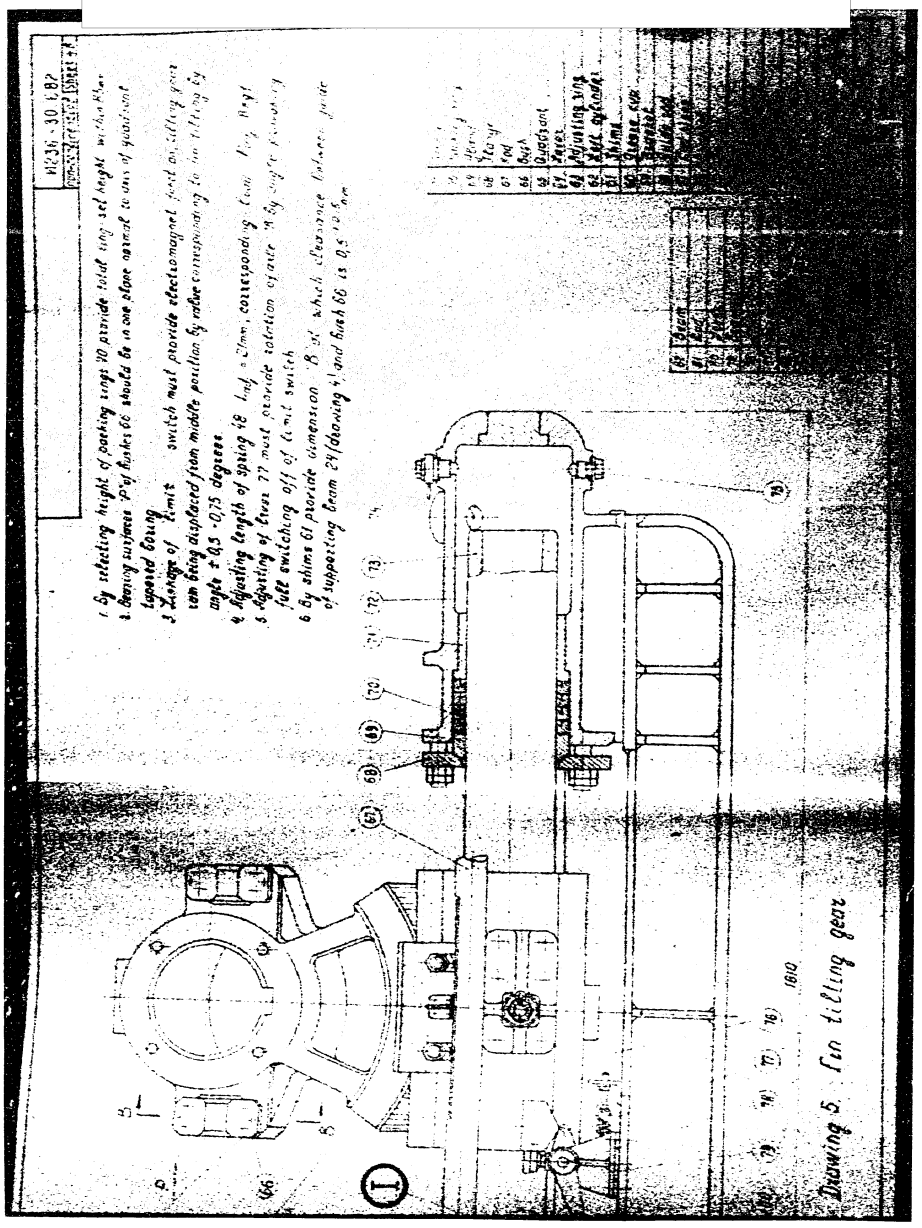

Drawing 5 Gun tilting gear

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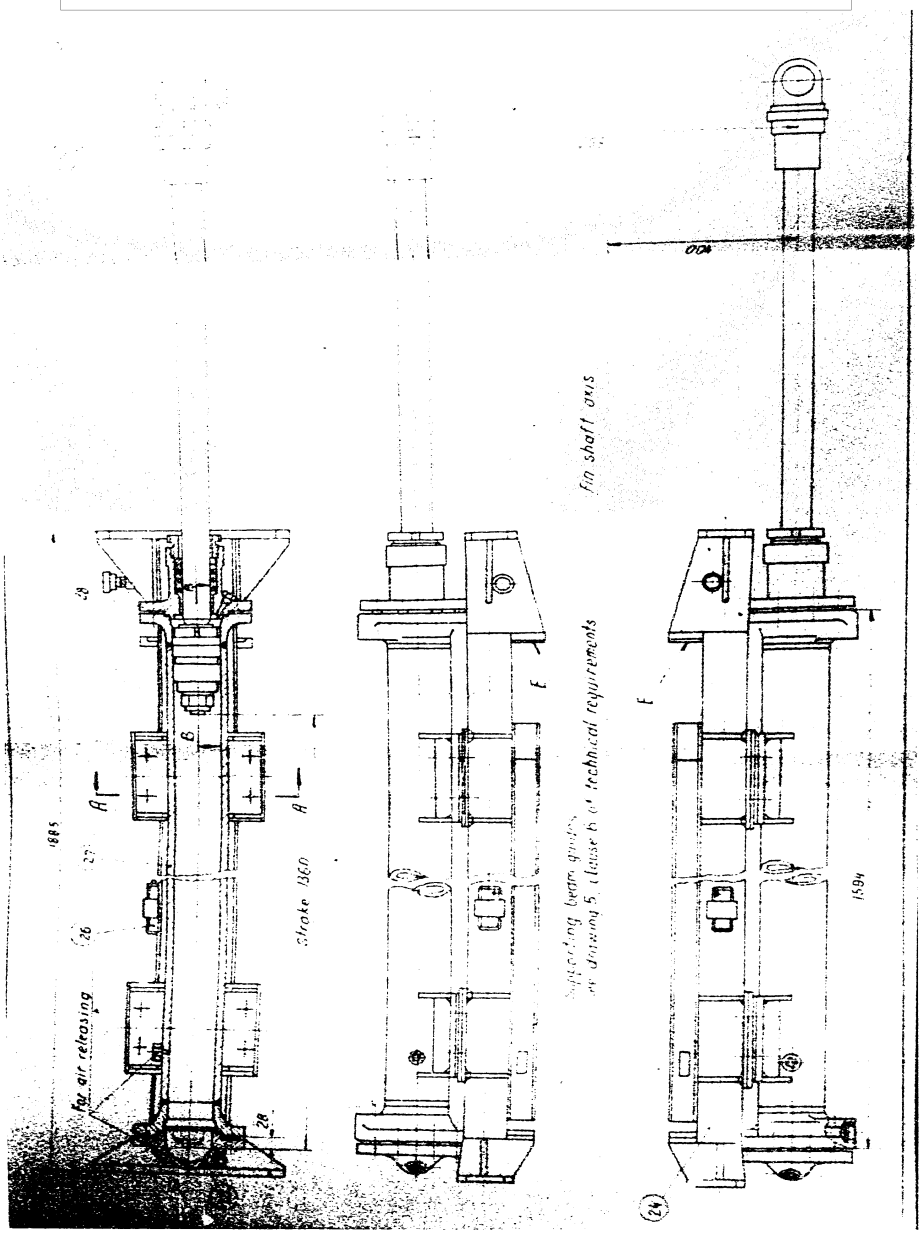

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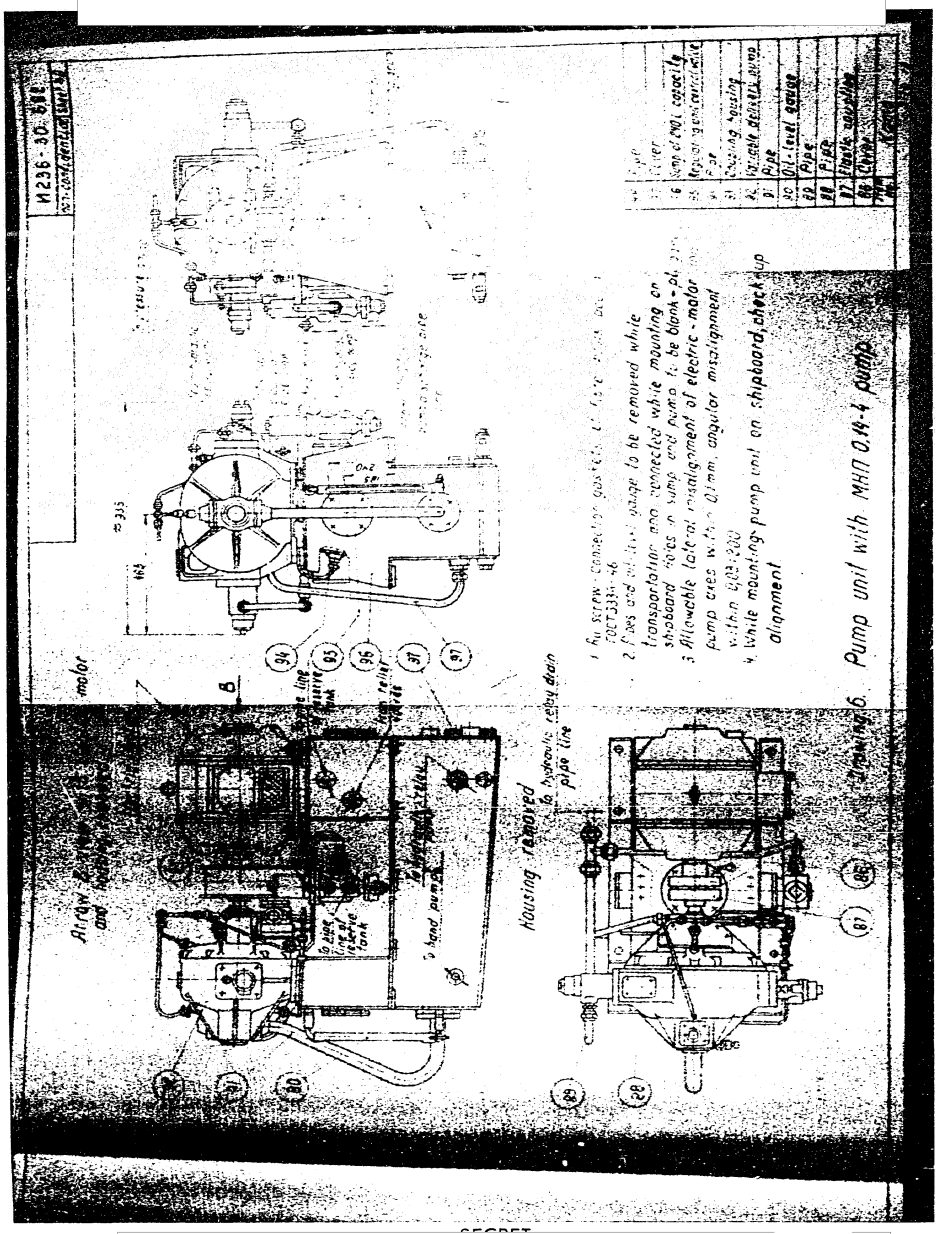

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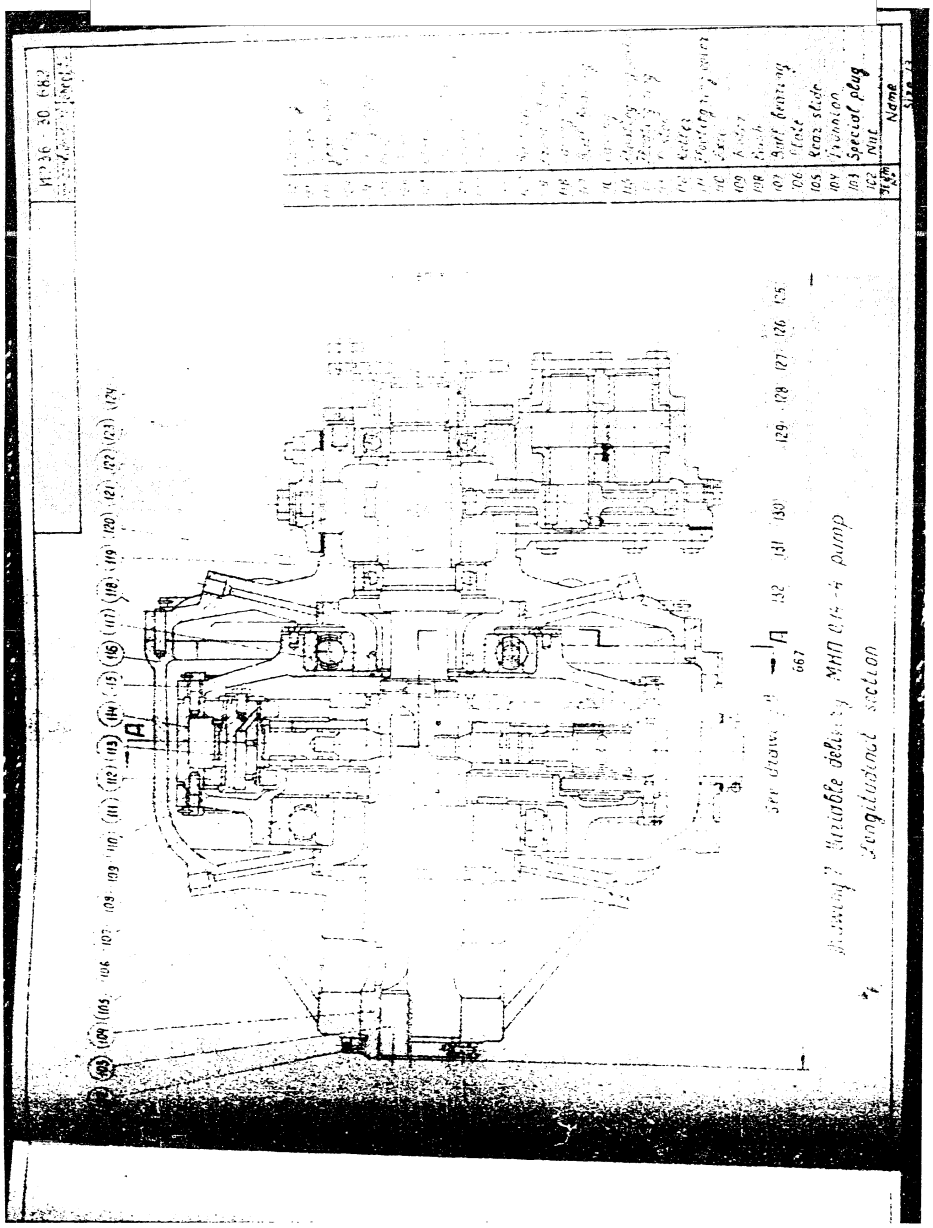

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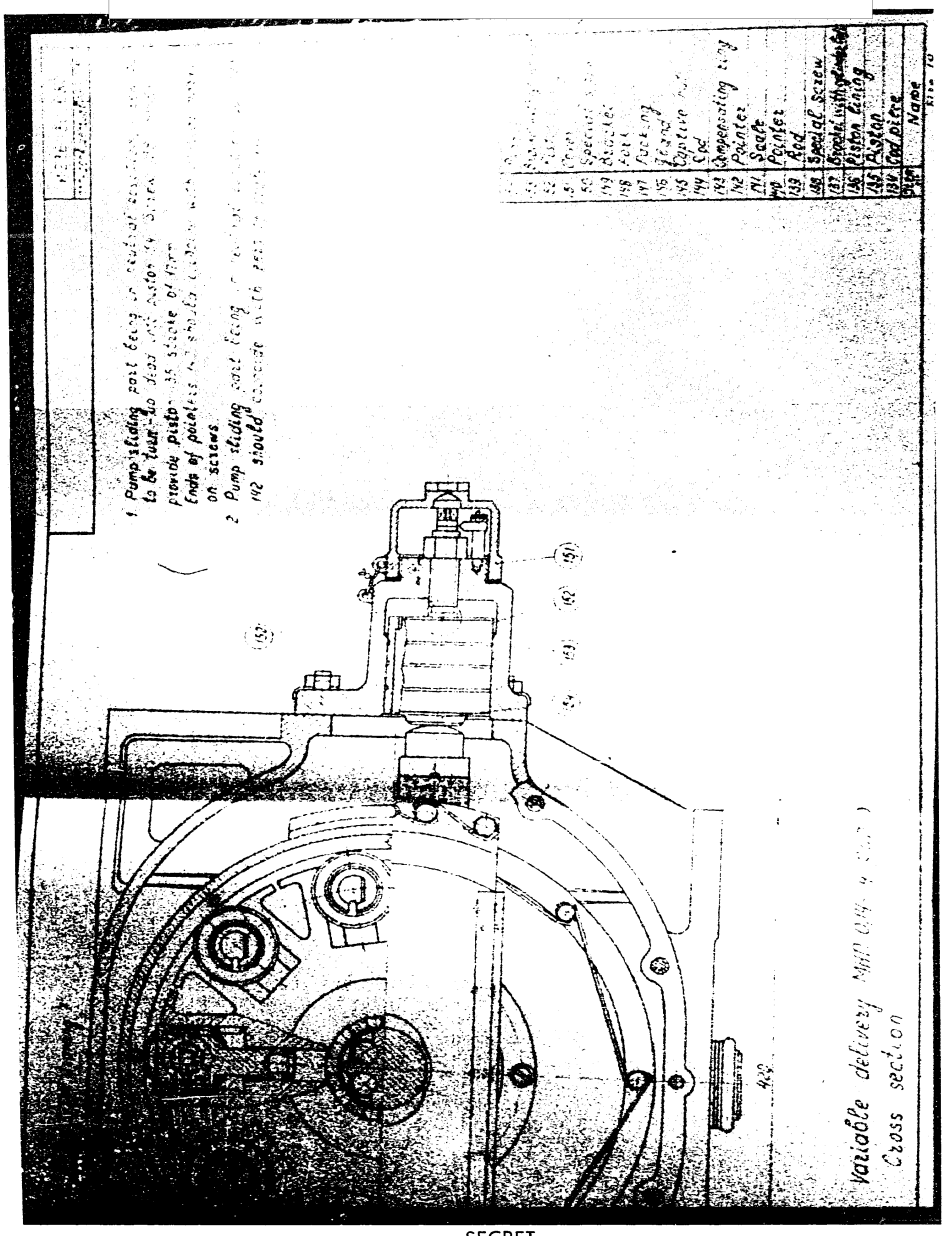

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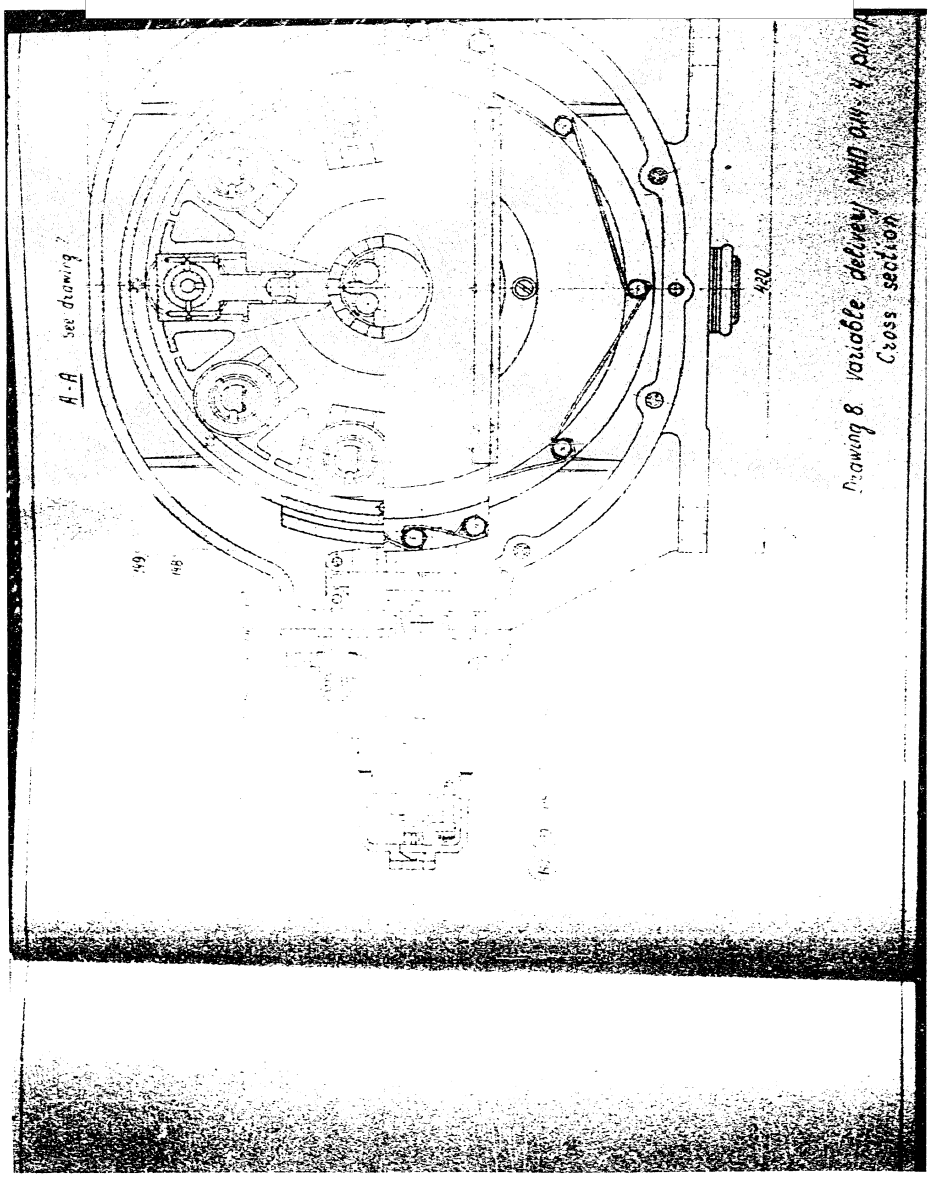

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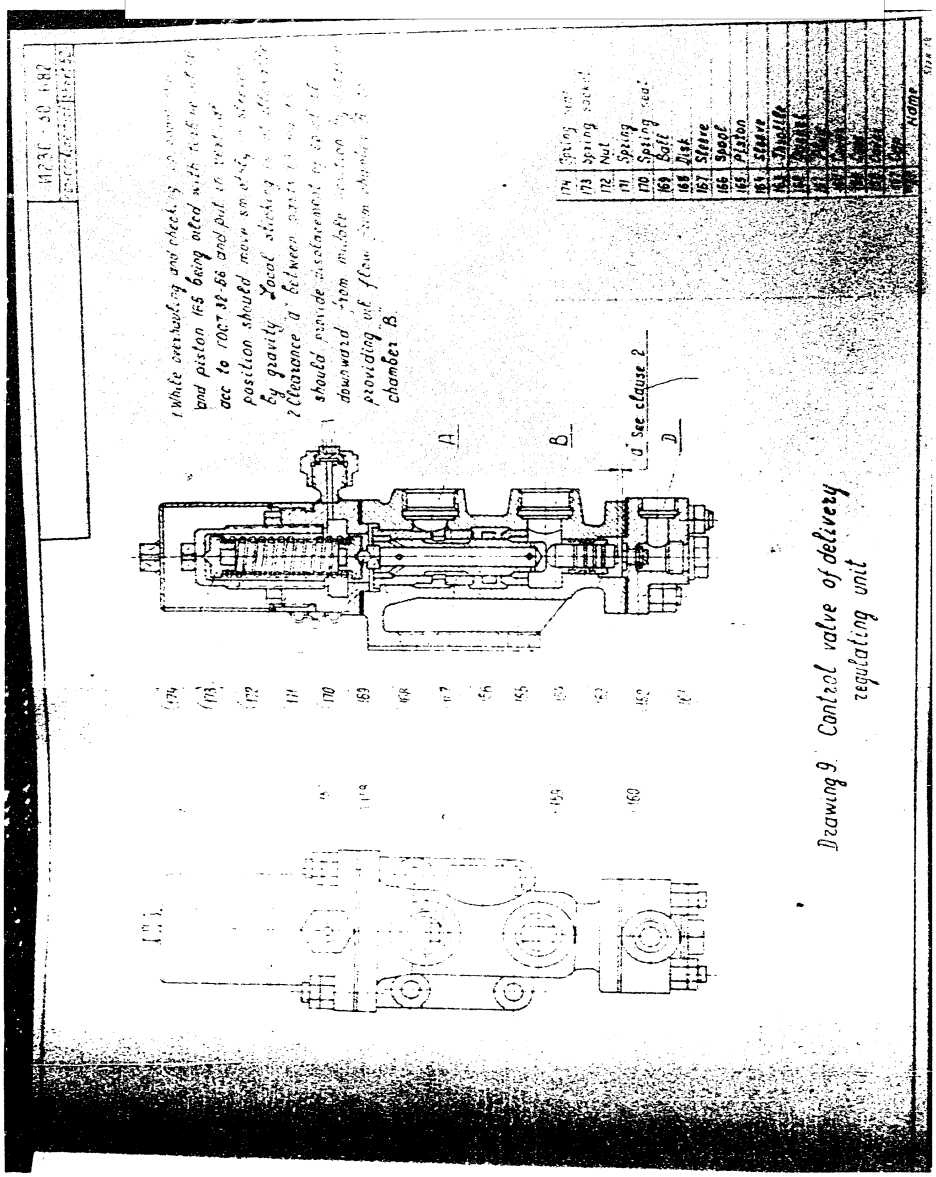

Drawing 9 Control valve of delivery regulating unit

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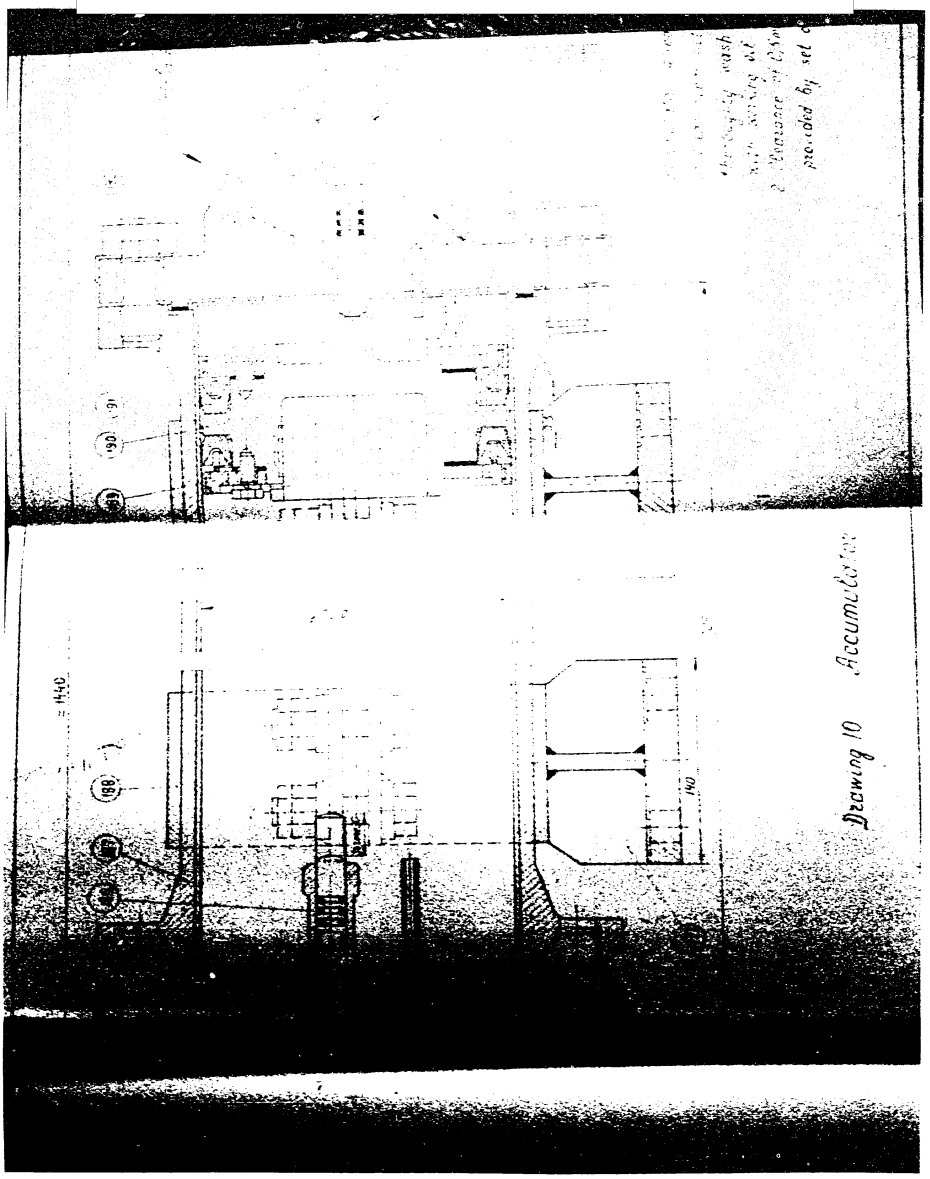

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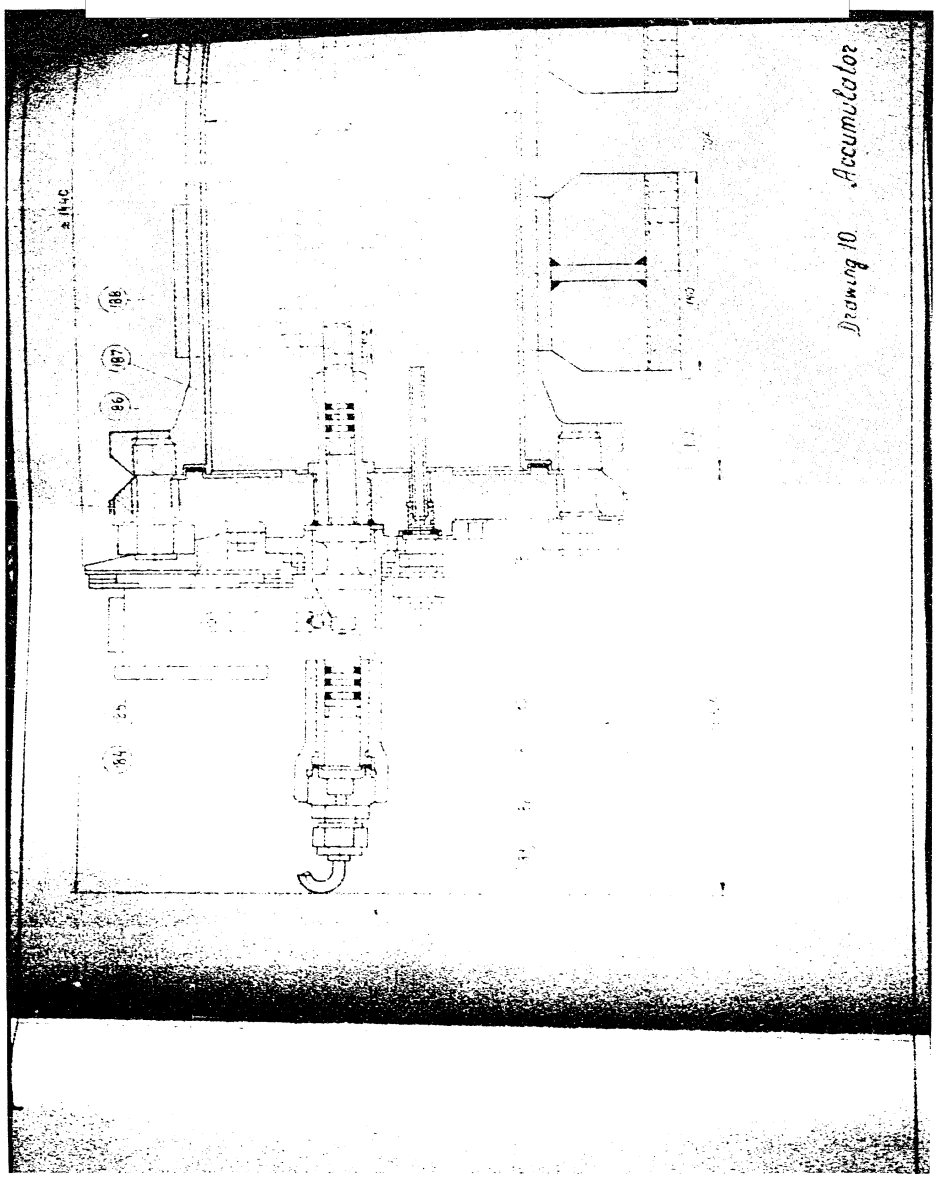

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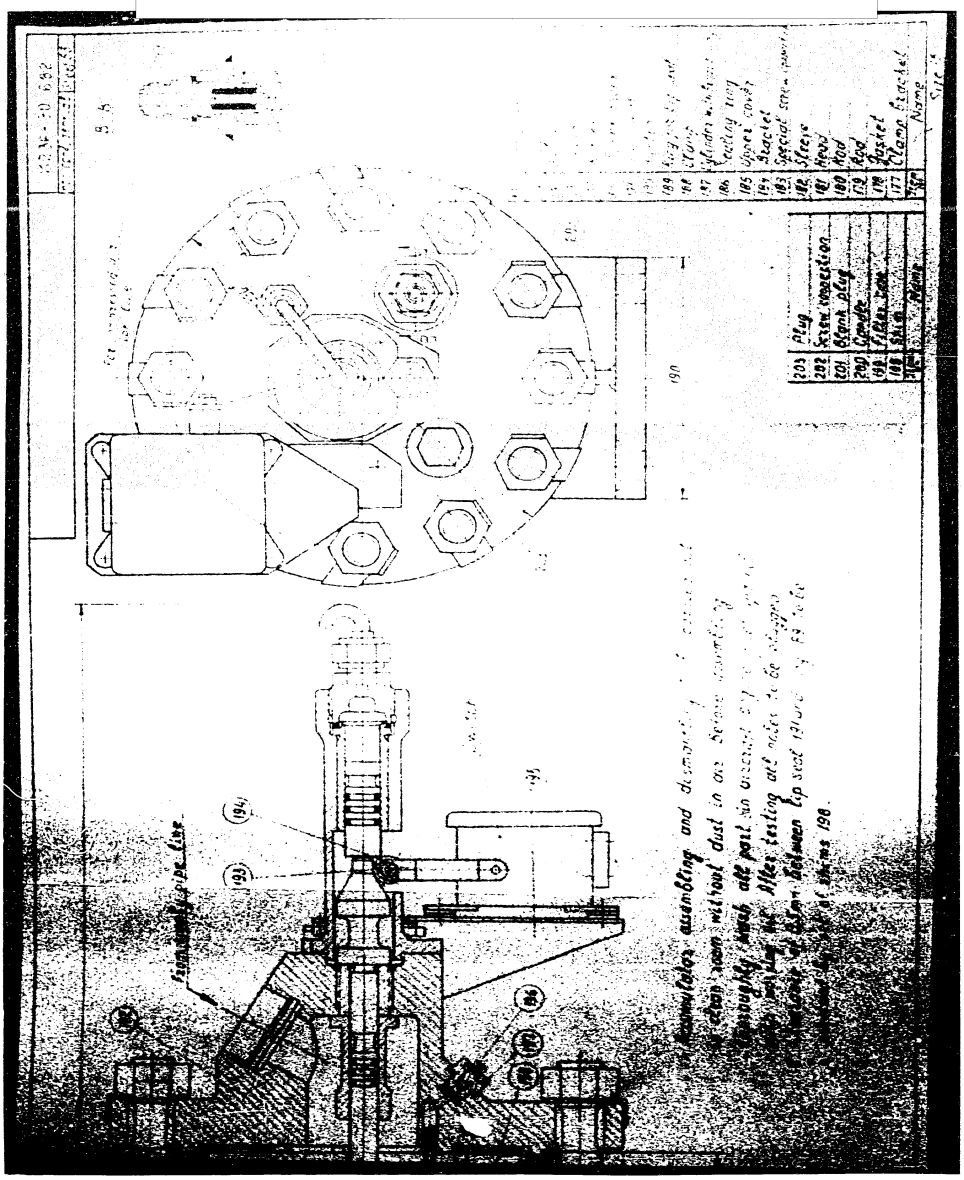

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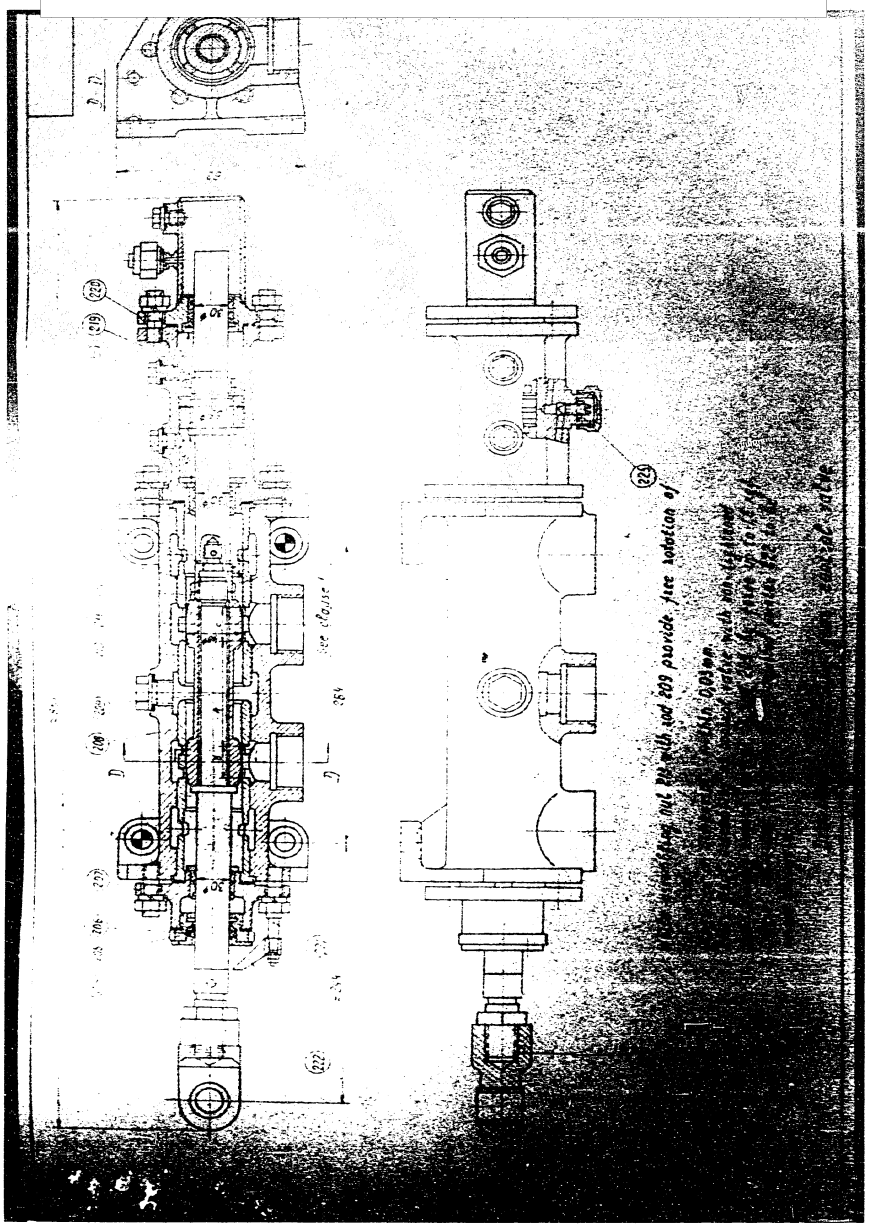

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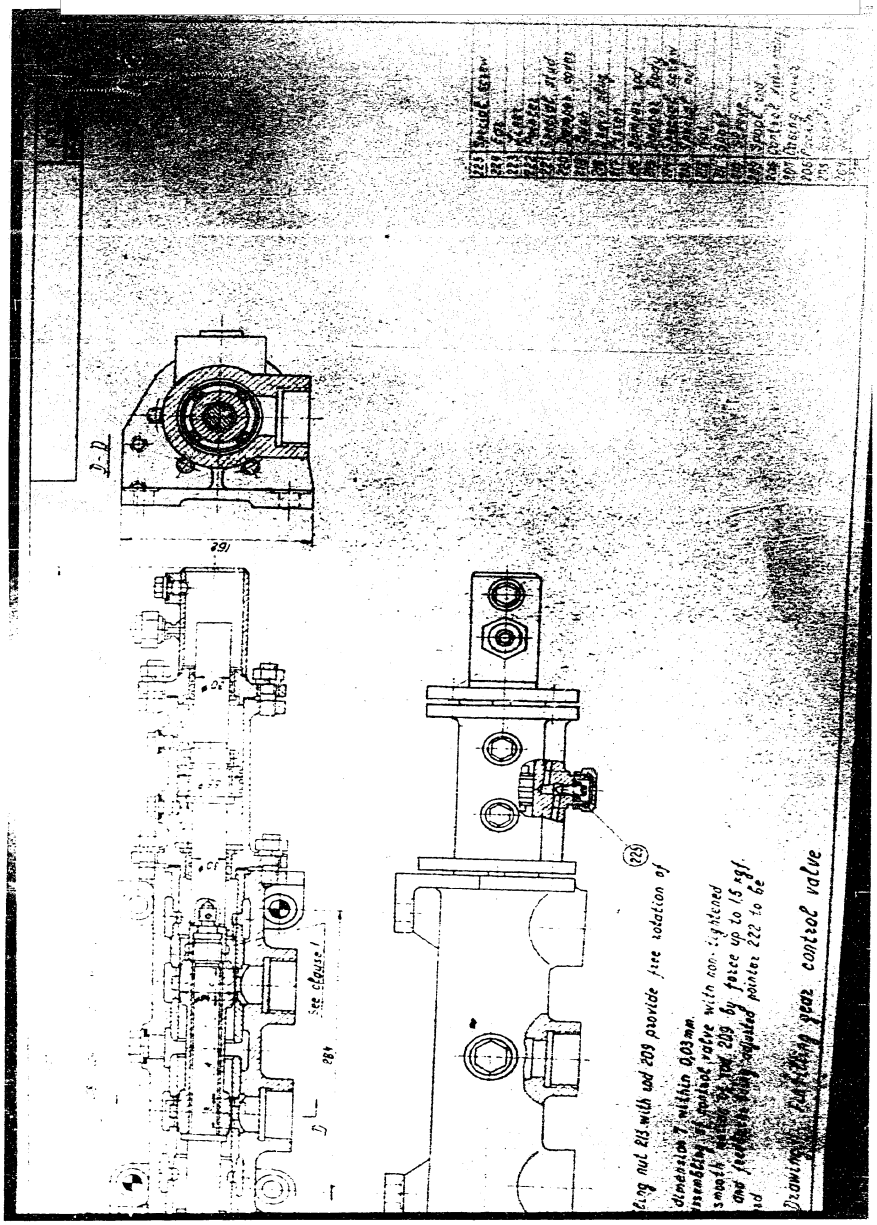

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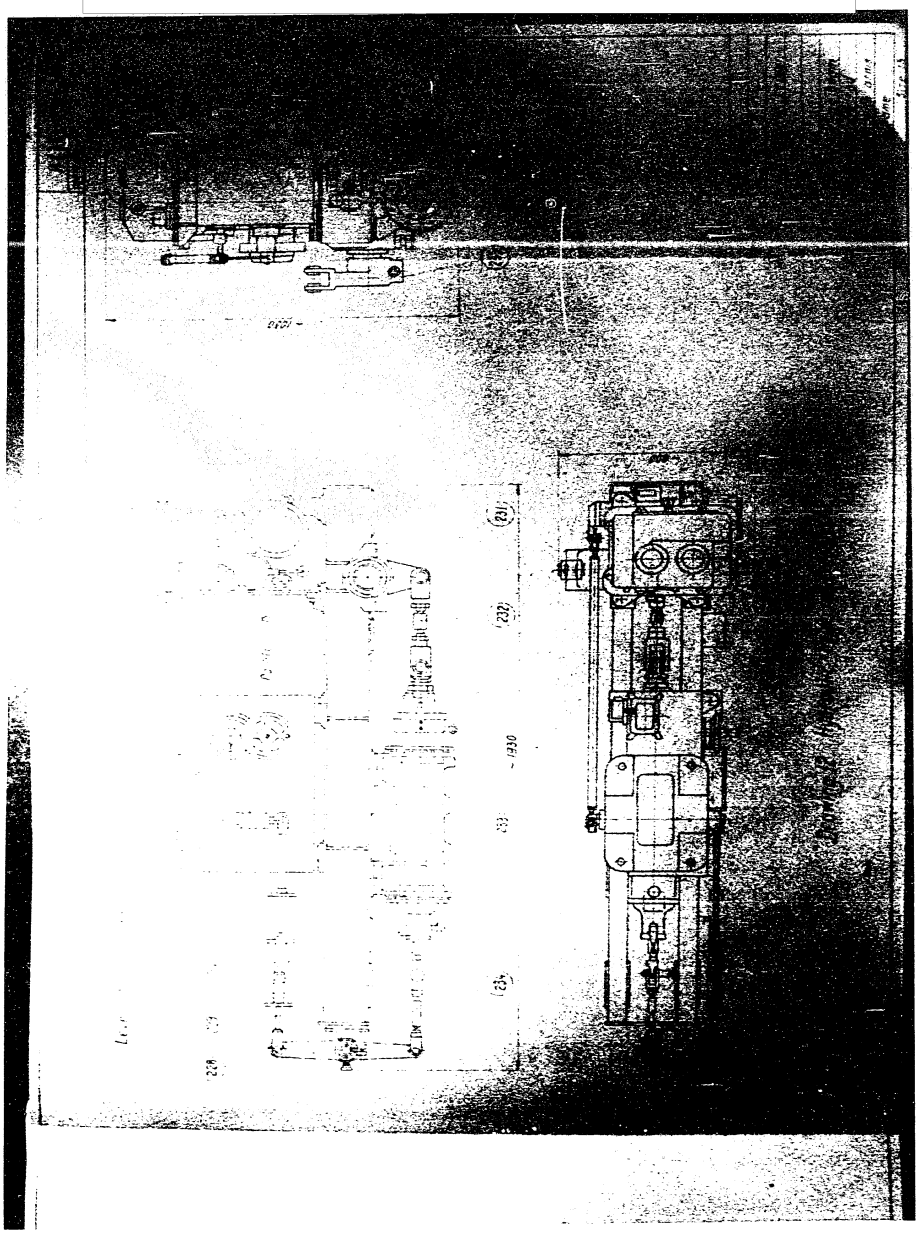

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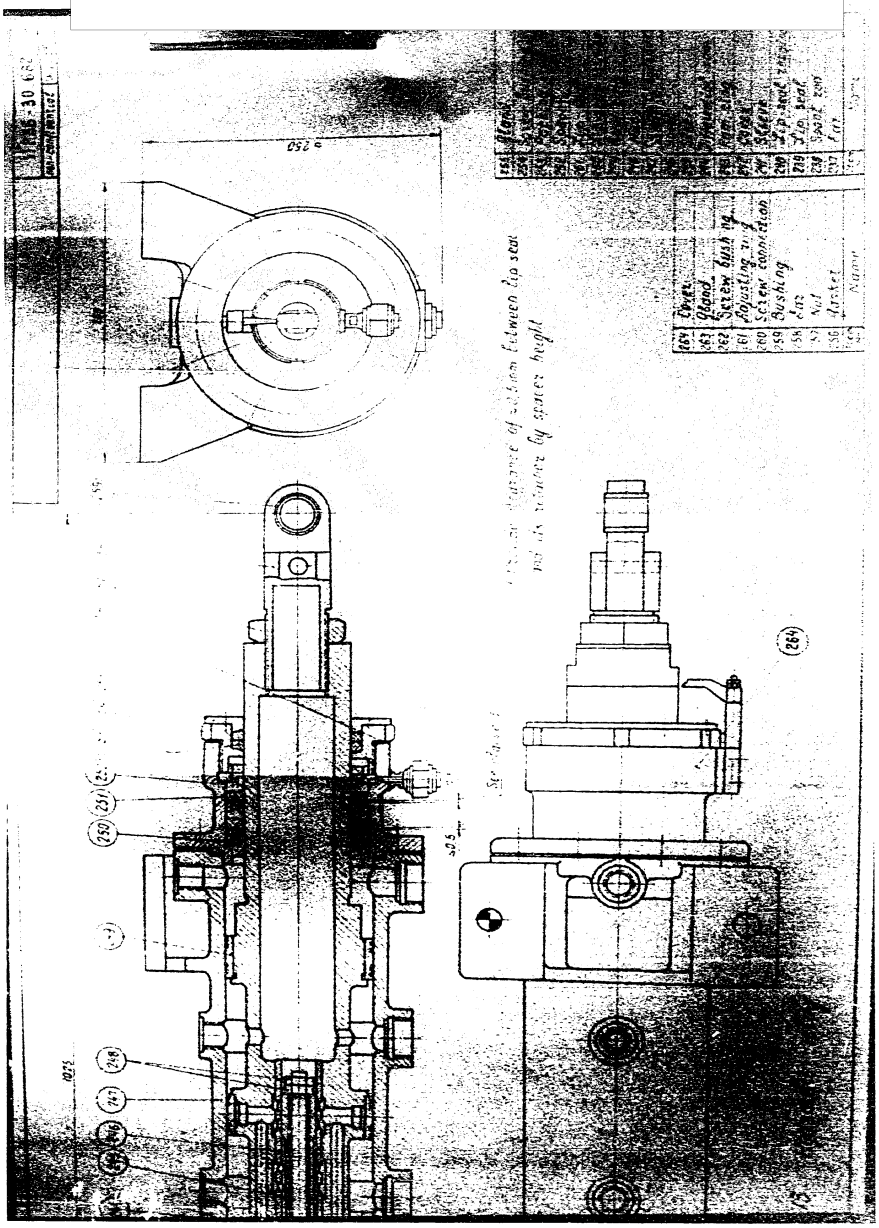

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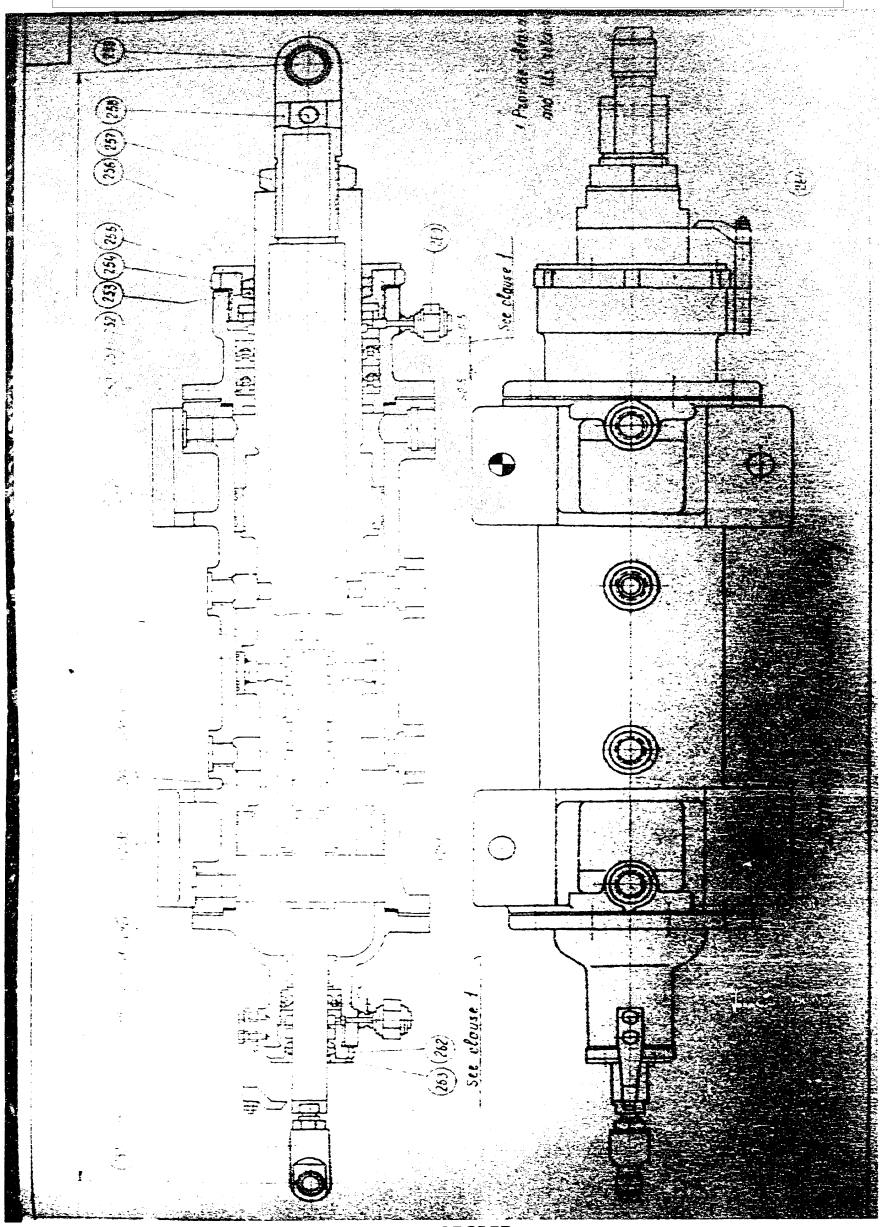

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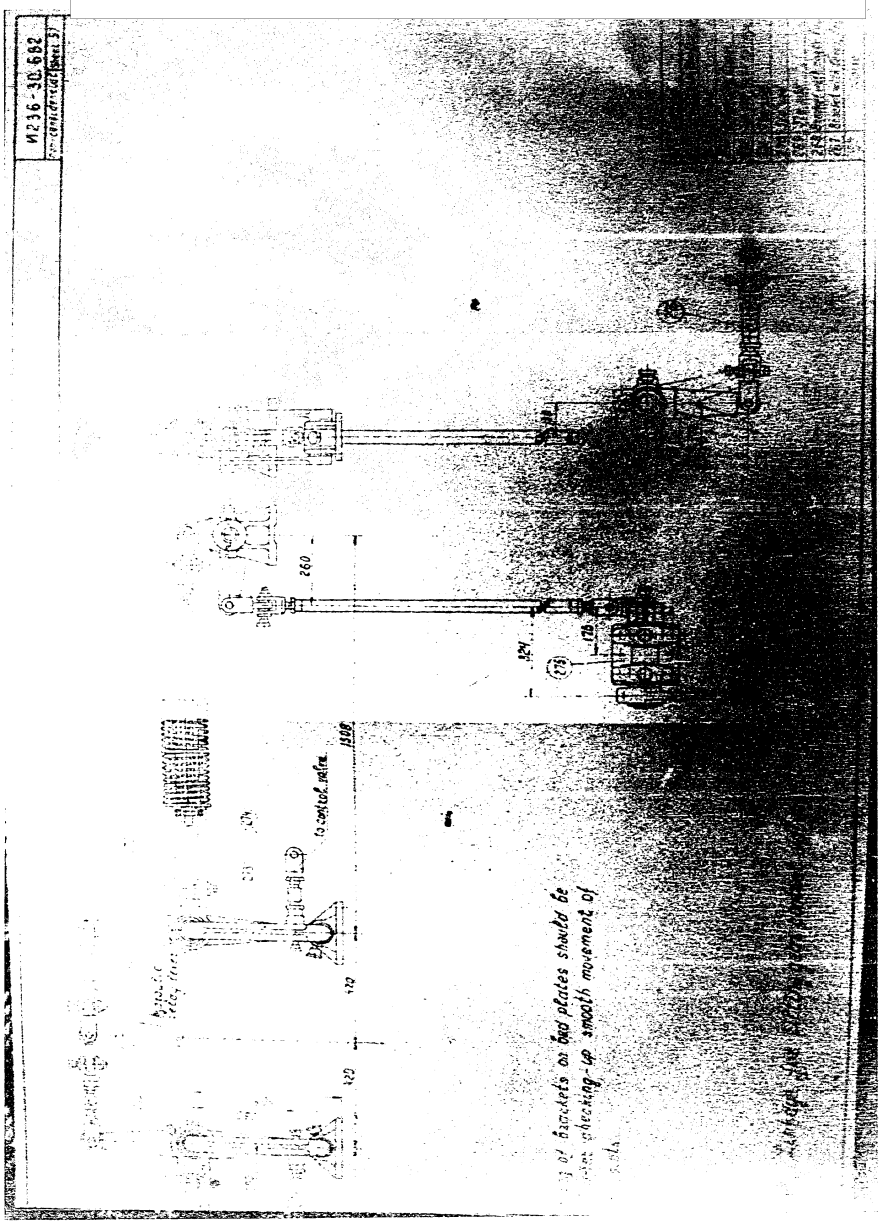

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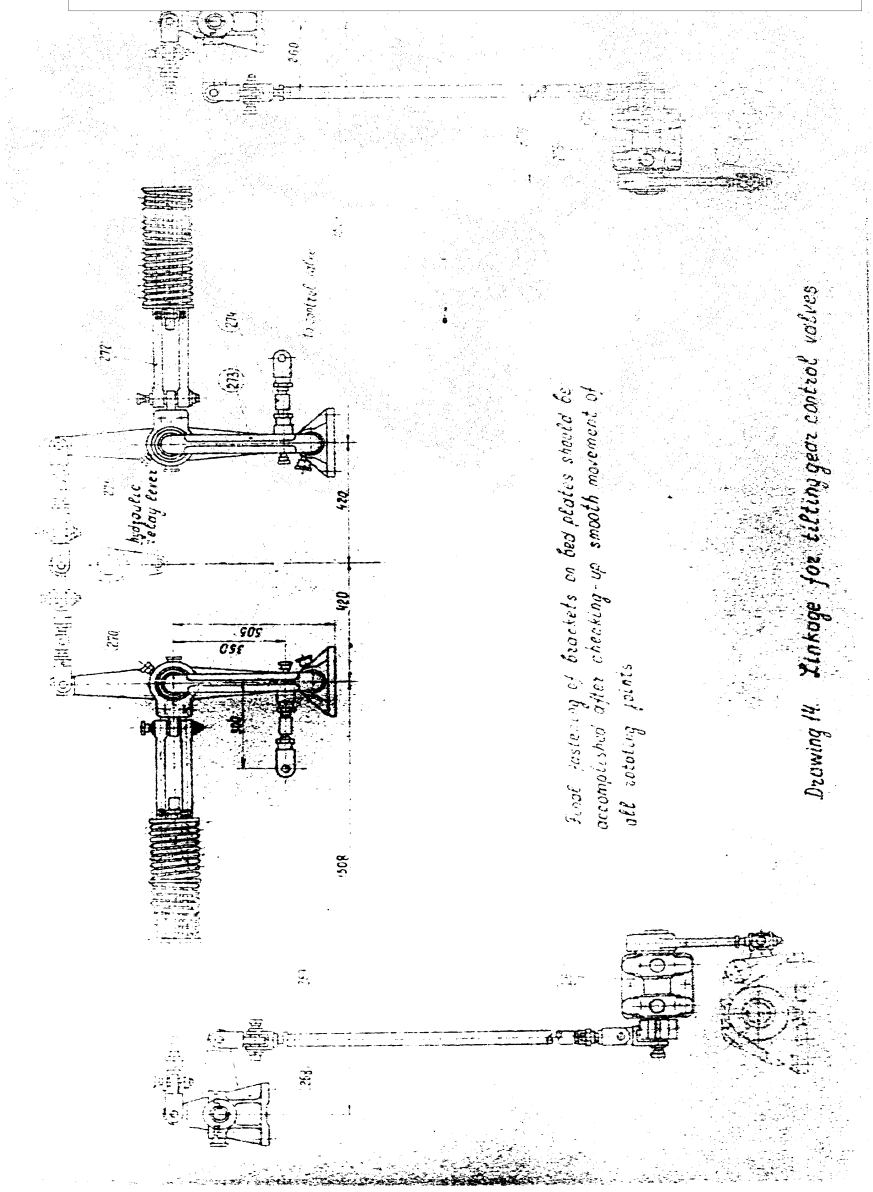

Drawing 14. Linkage for lifting gear control valves

Front assembly of brackets on key plates should be accomplished after checking-up smooth movement of all actuating parts

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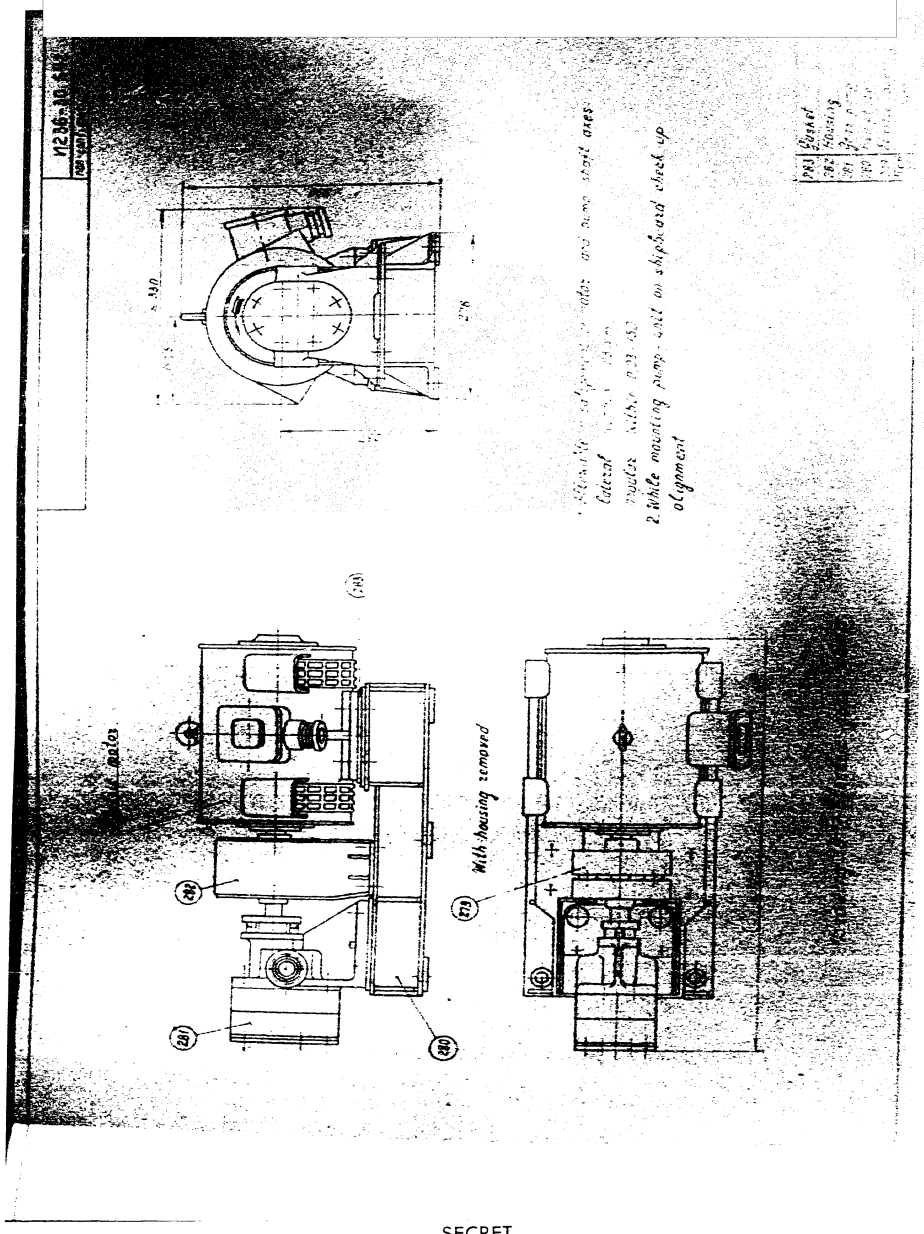

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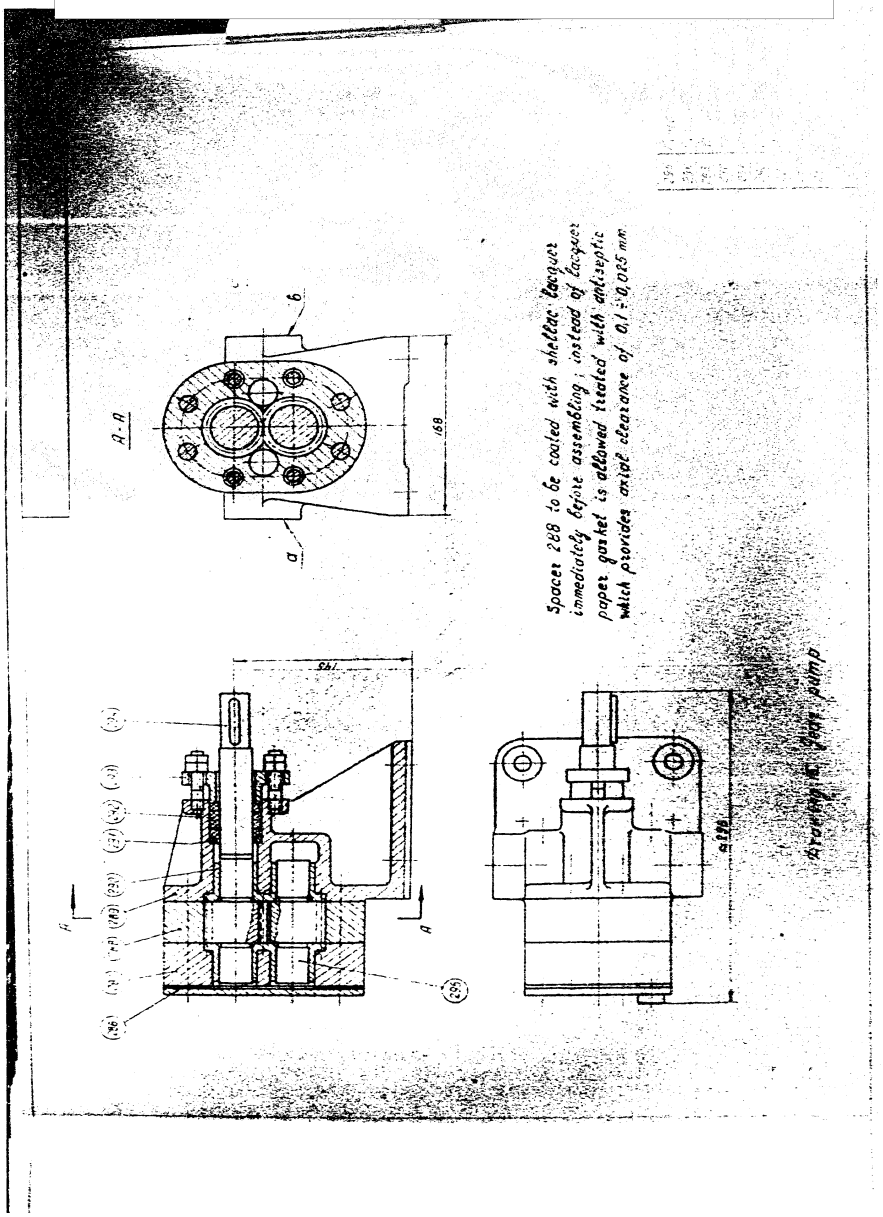

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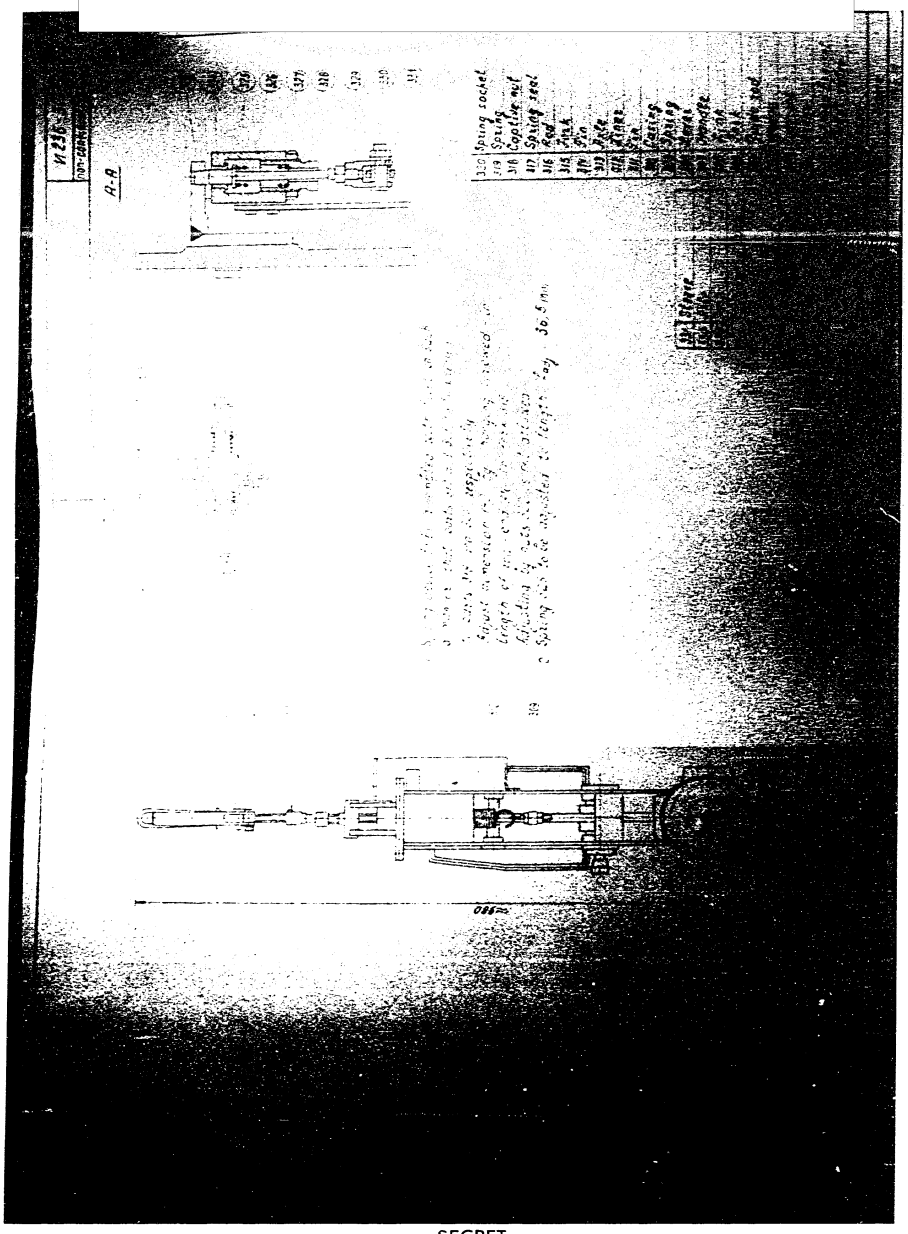

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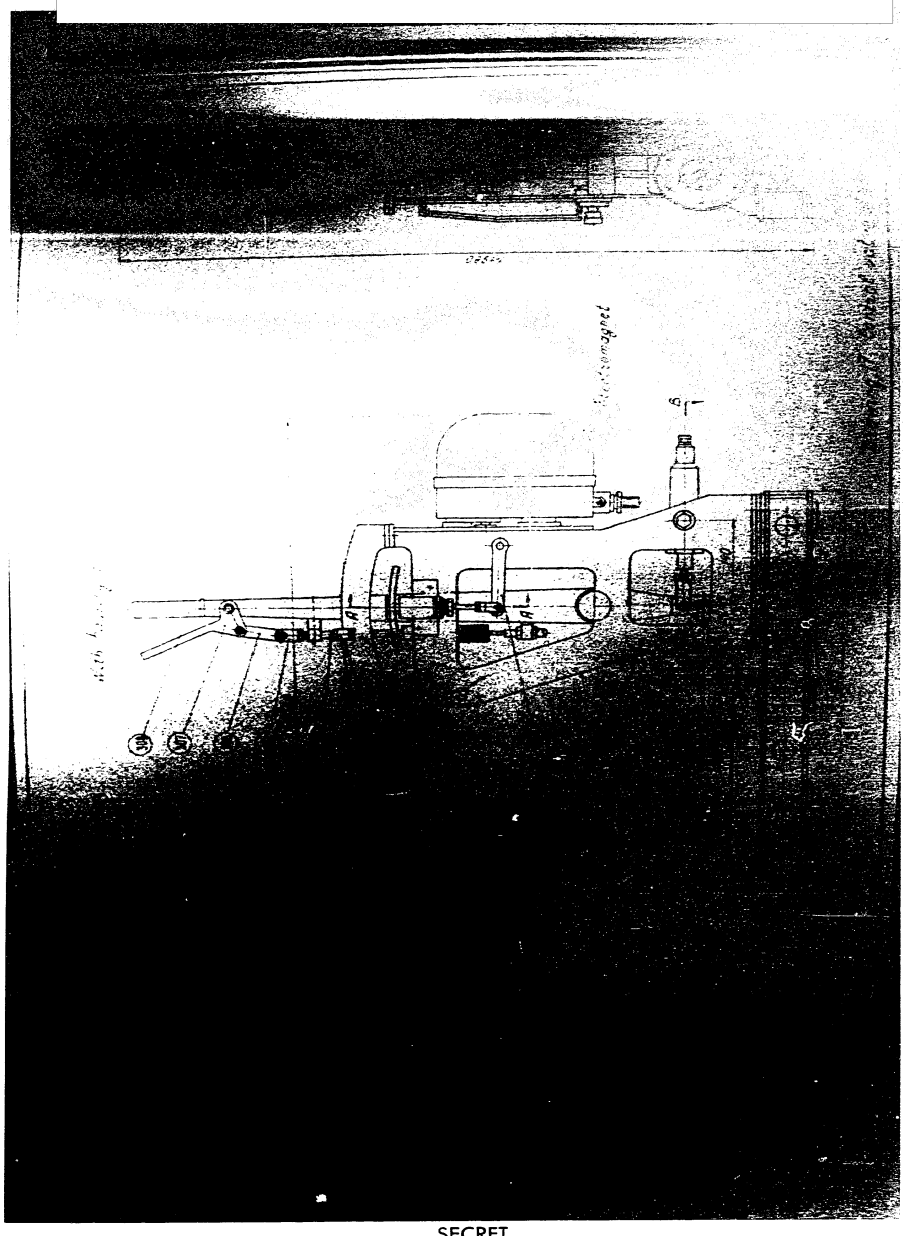

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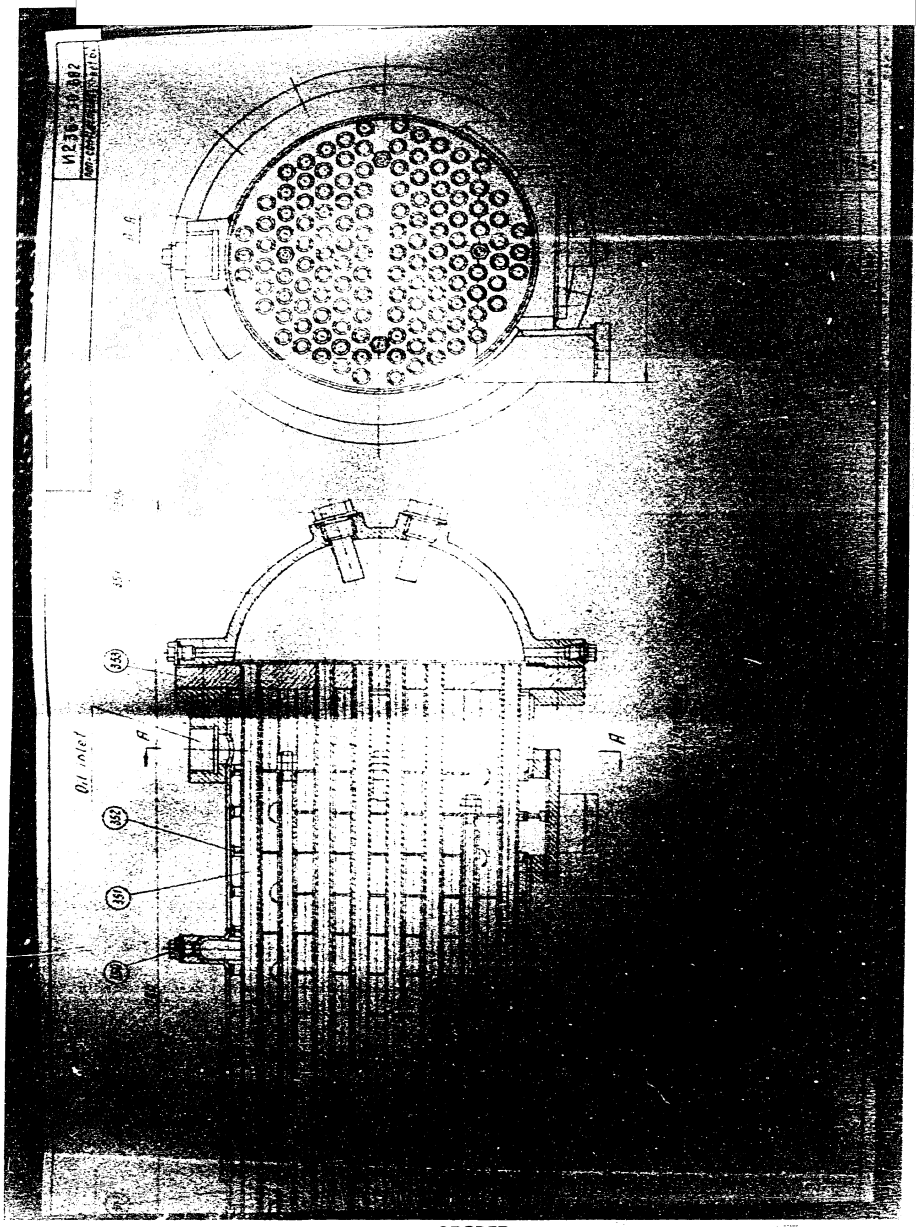

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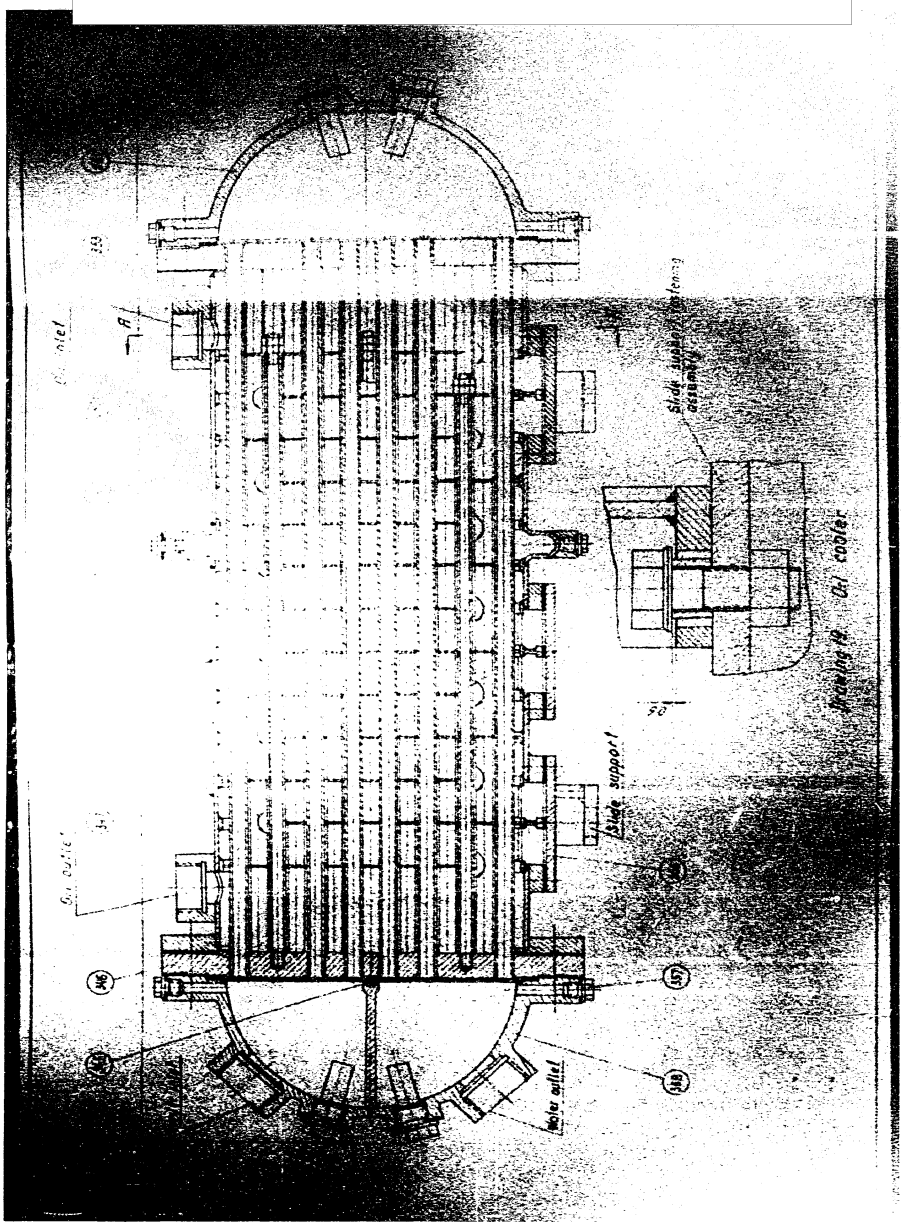

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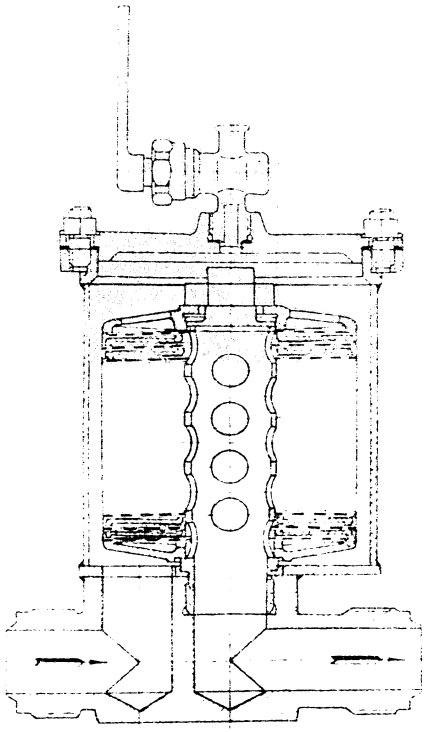

Drawing 20 Oil filter

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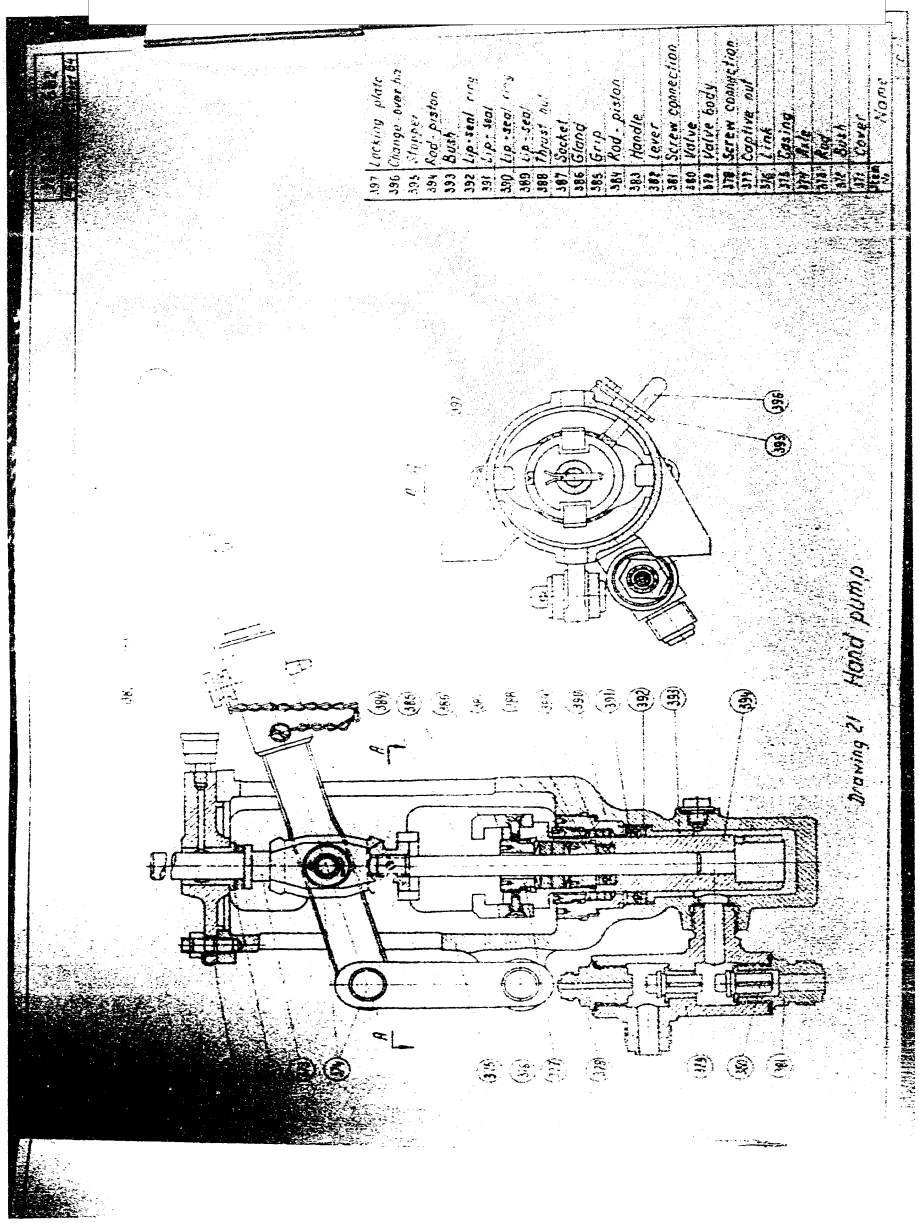

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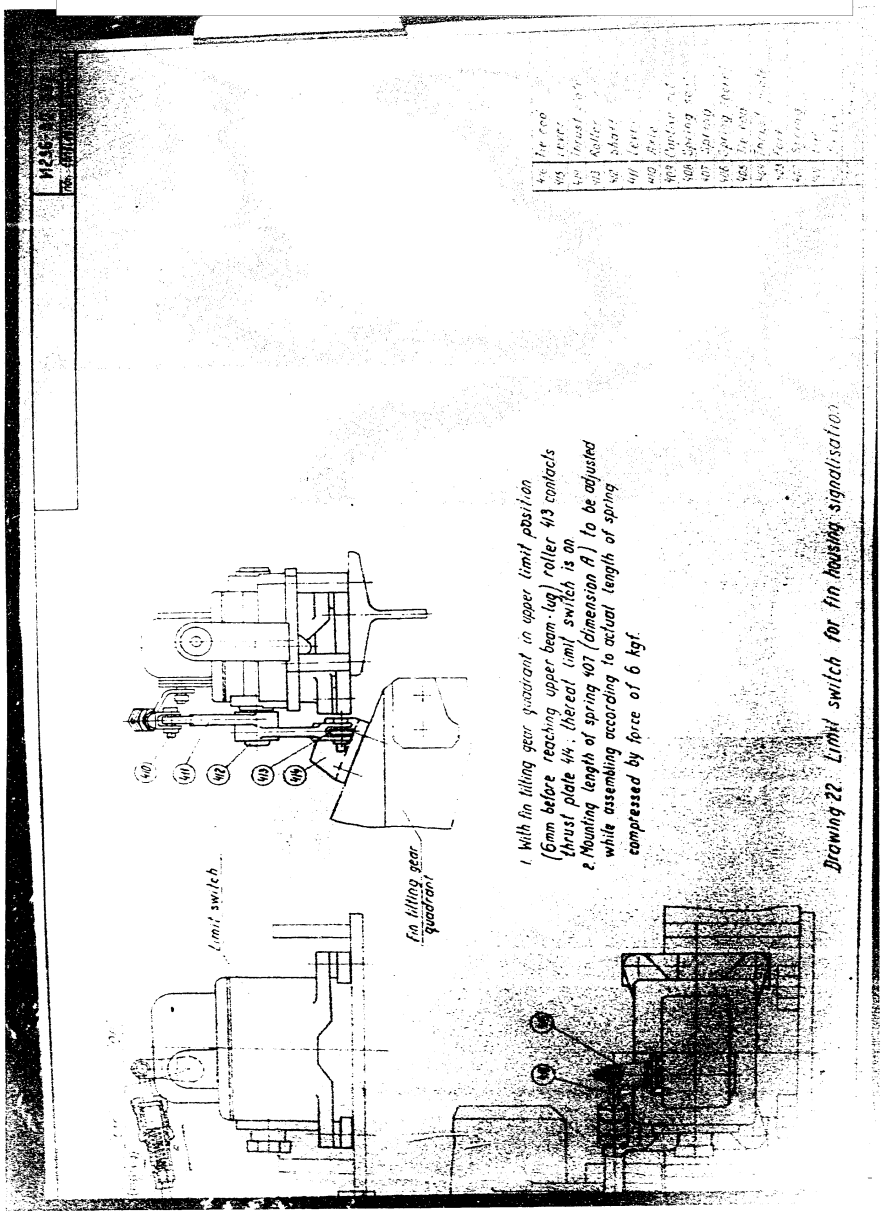

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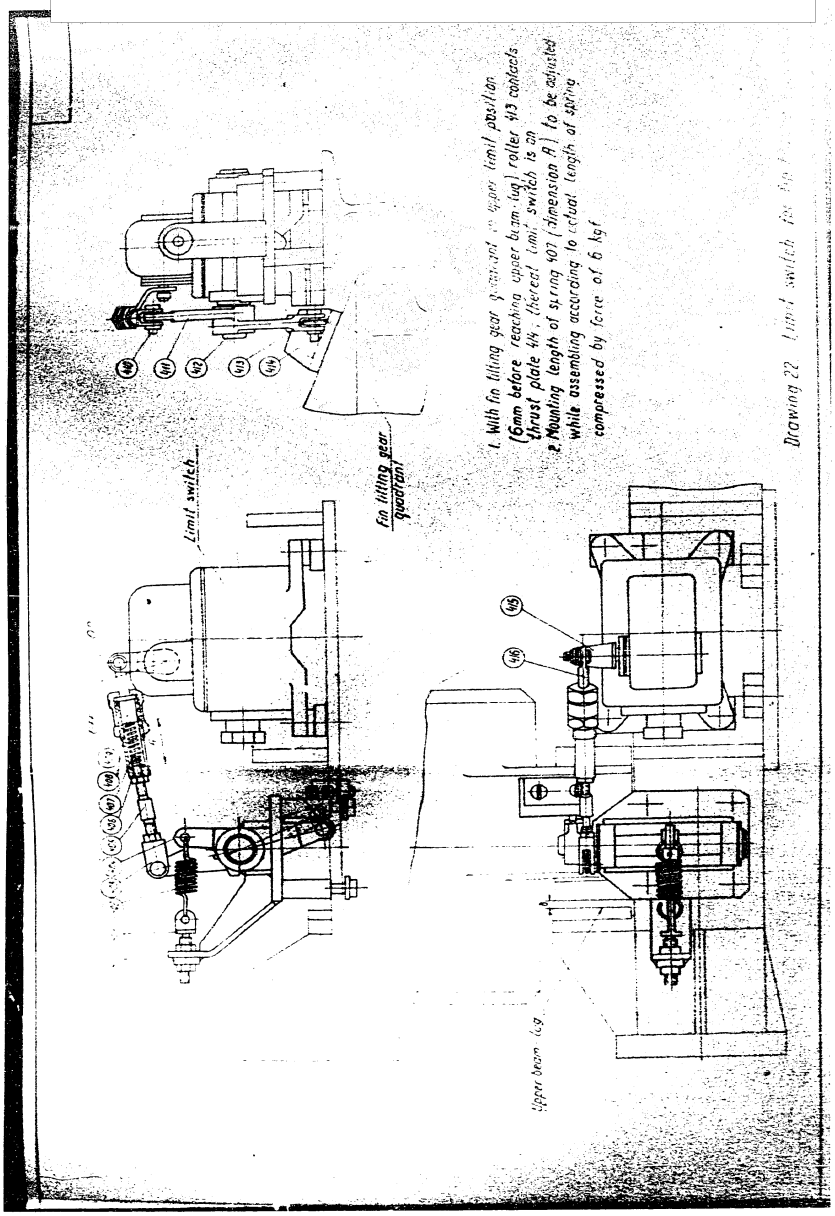

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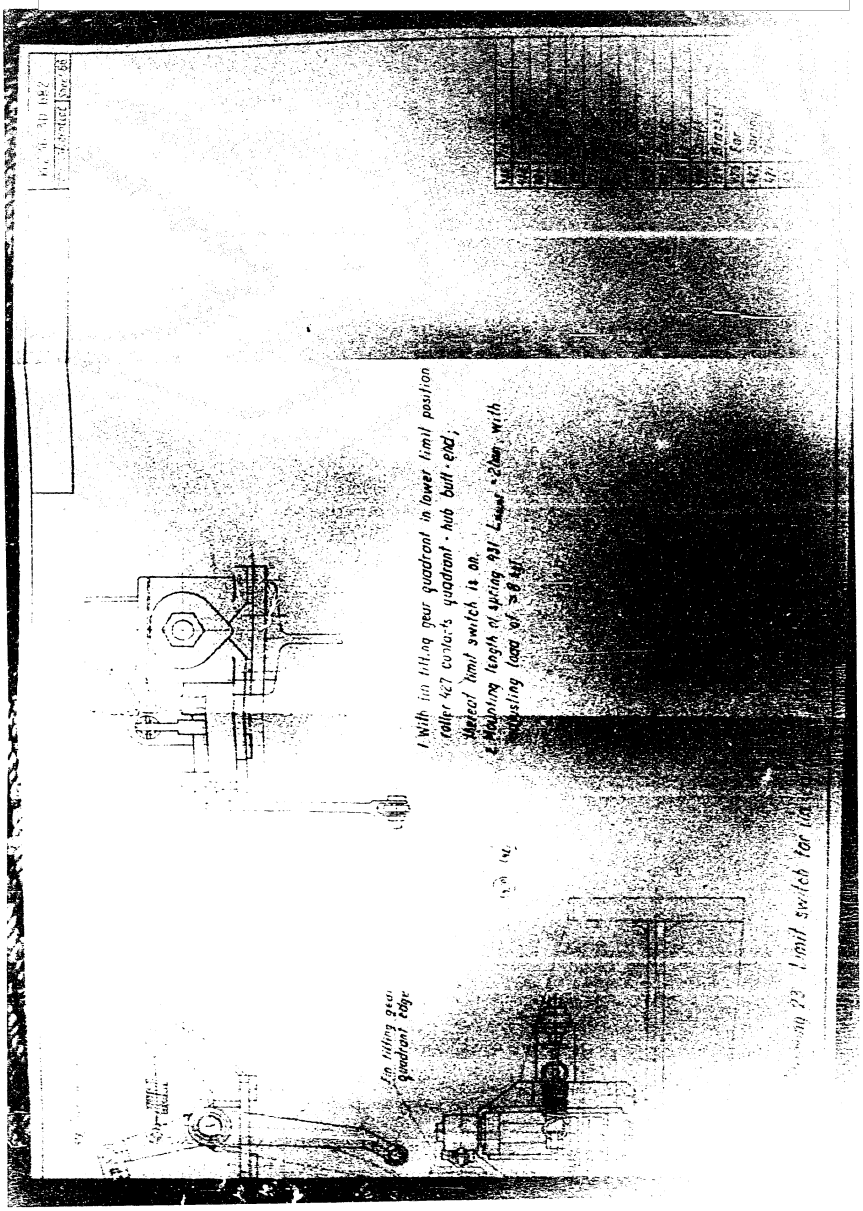

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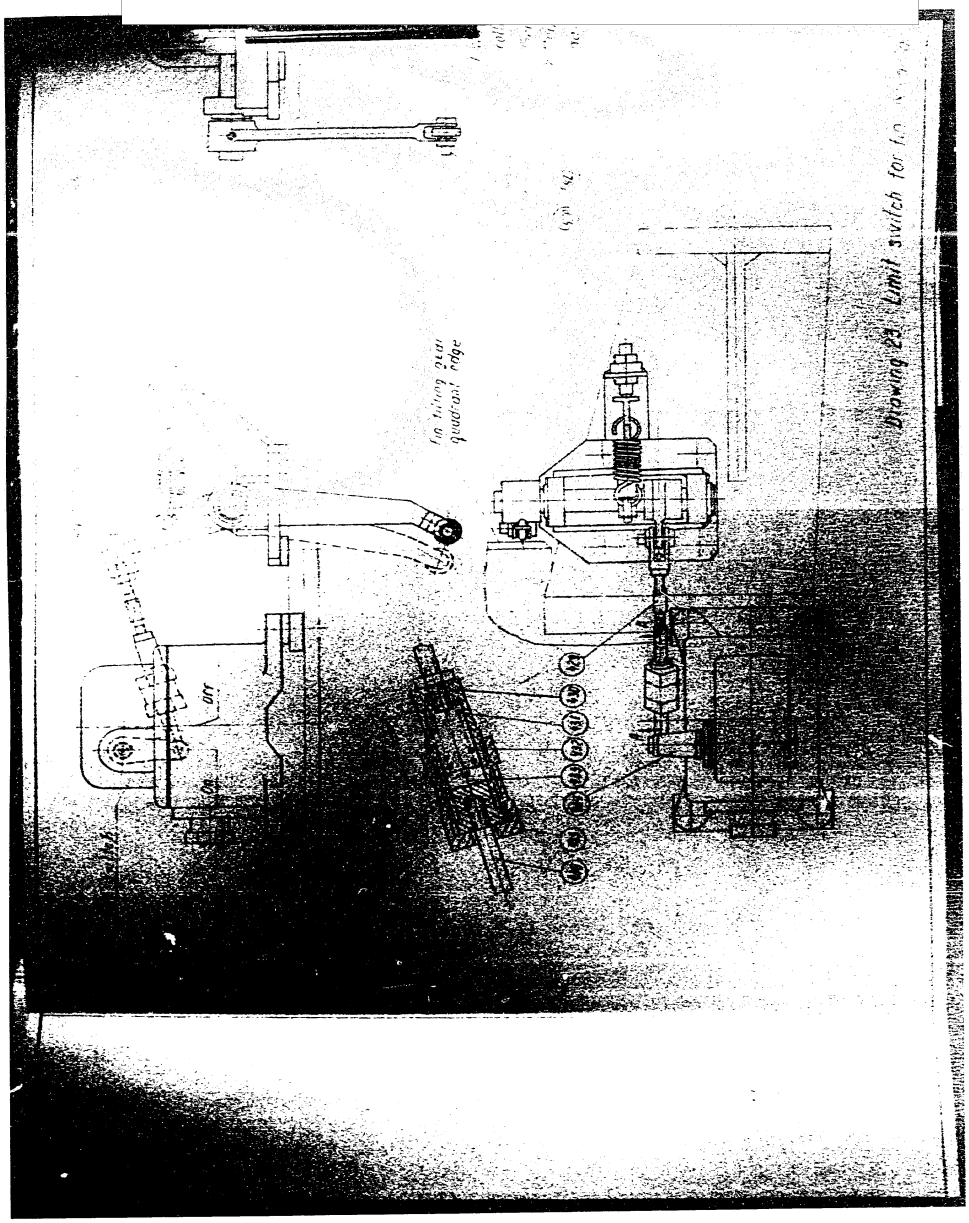

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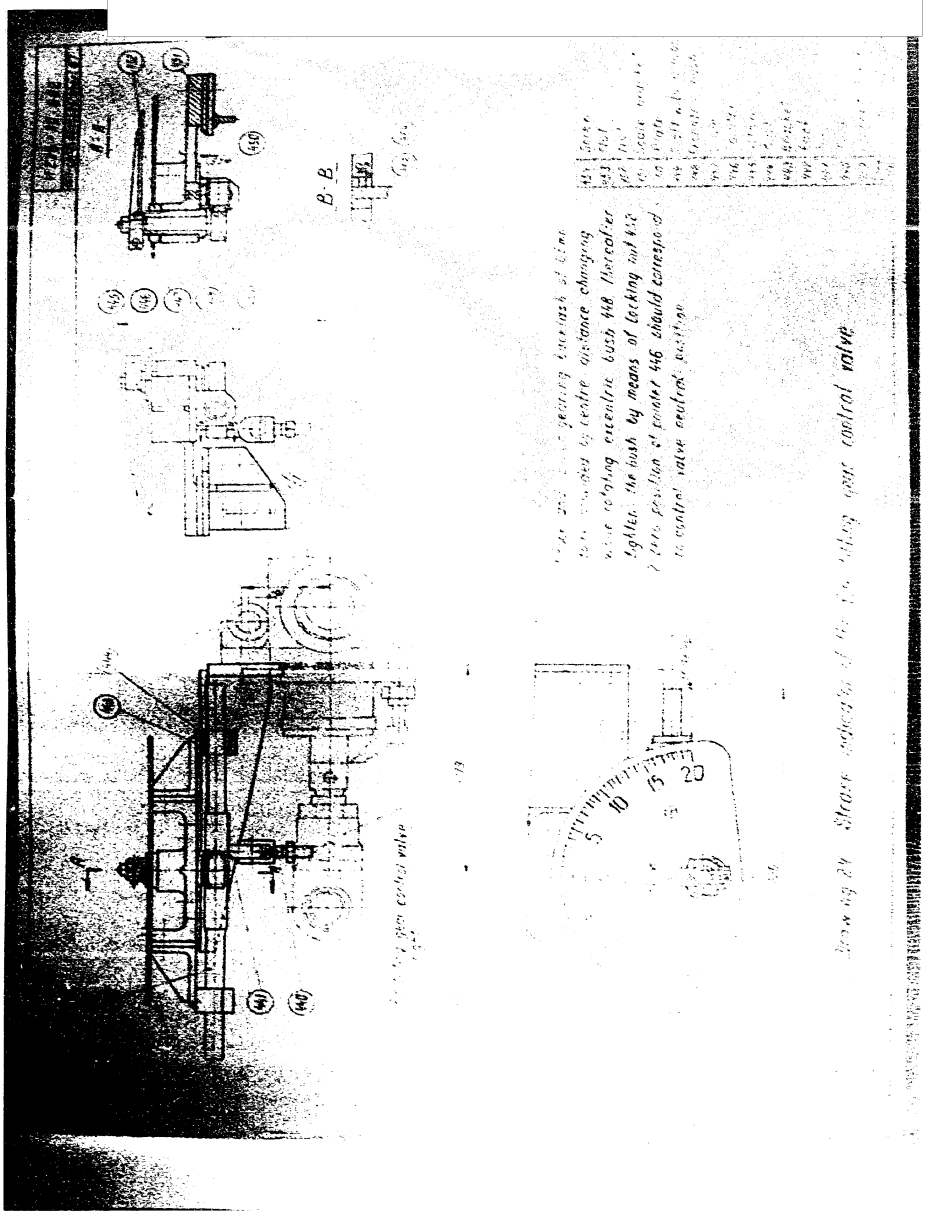

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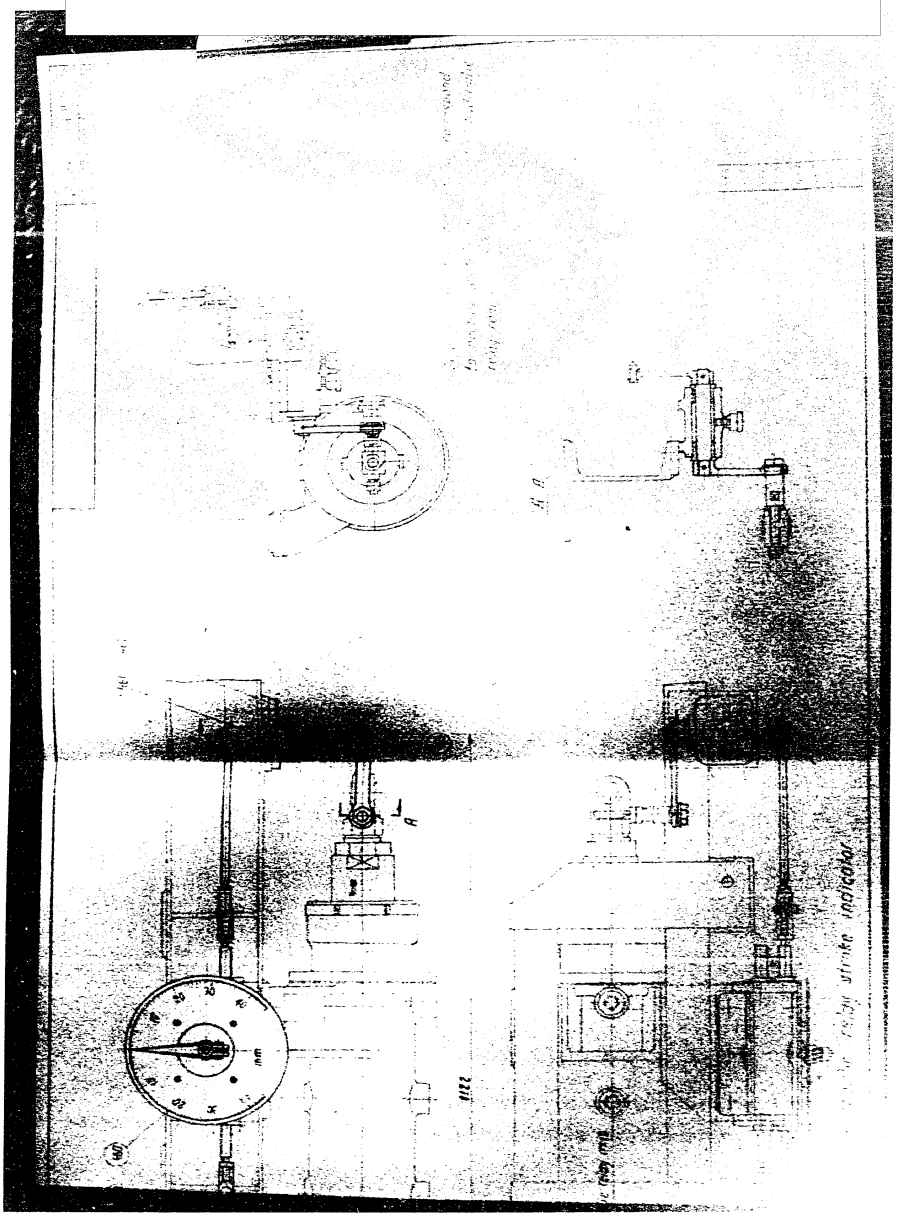

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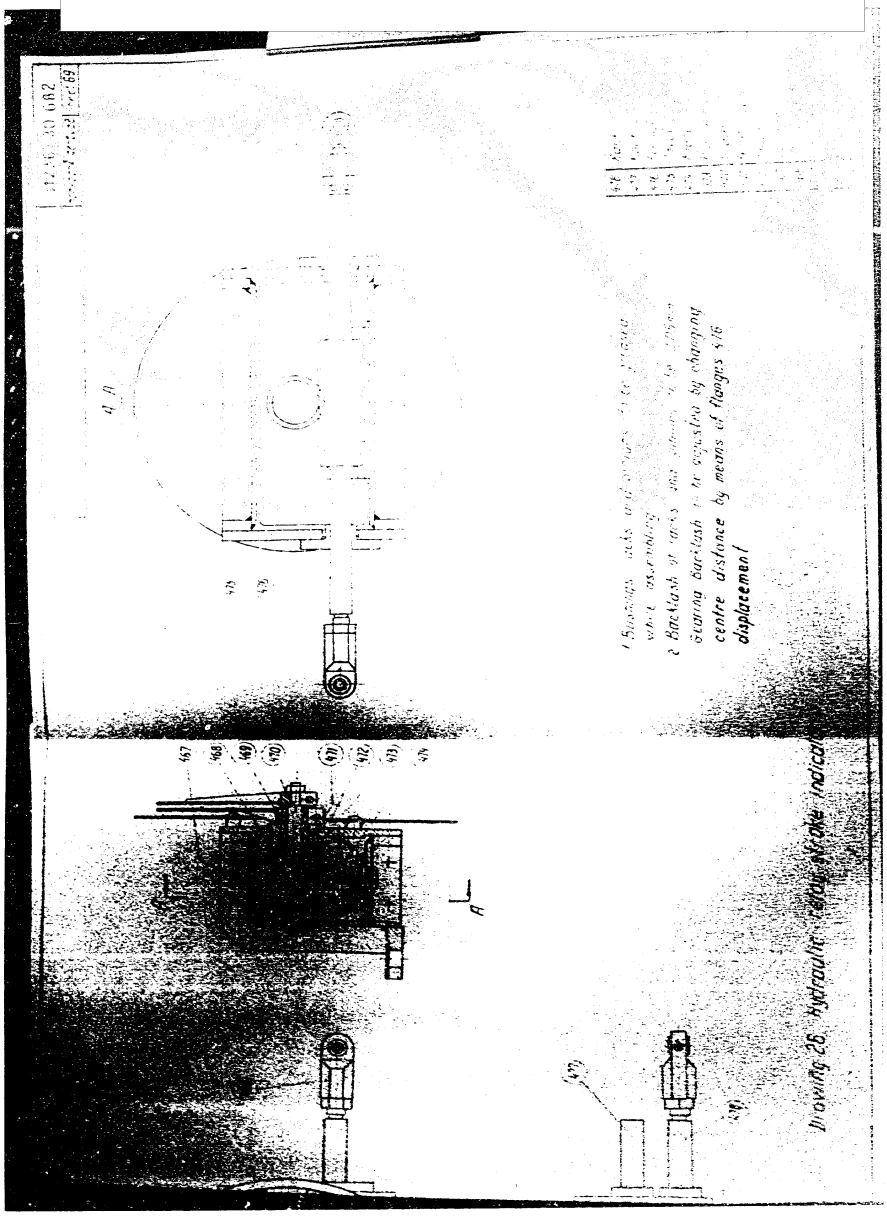

Drawing 26. Hydraulic servo-stroke indicator

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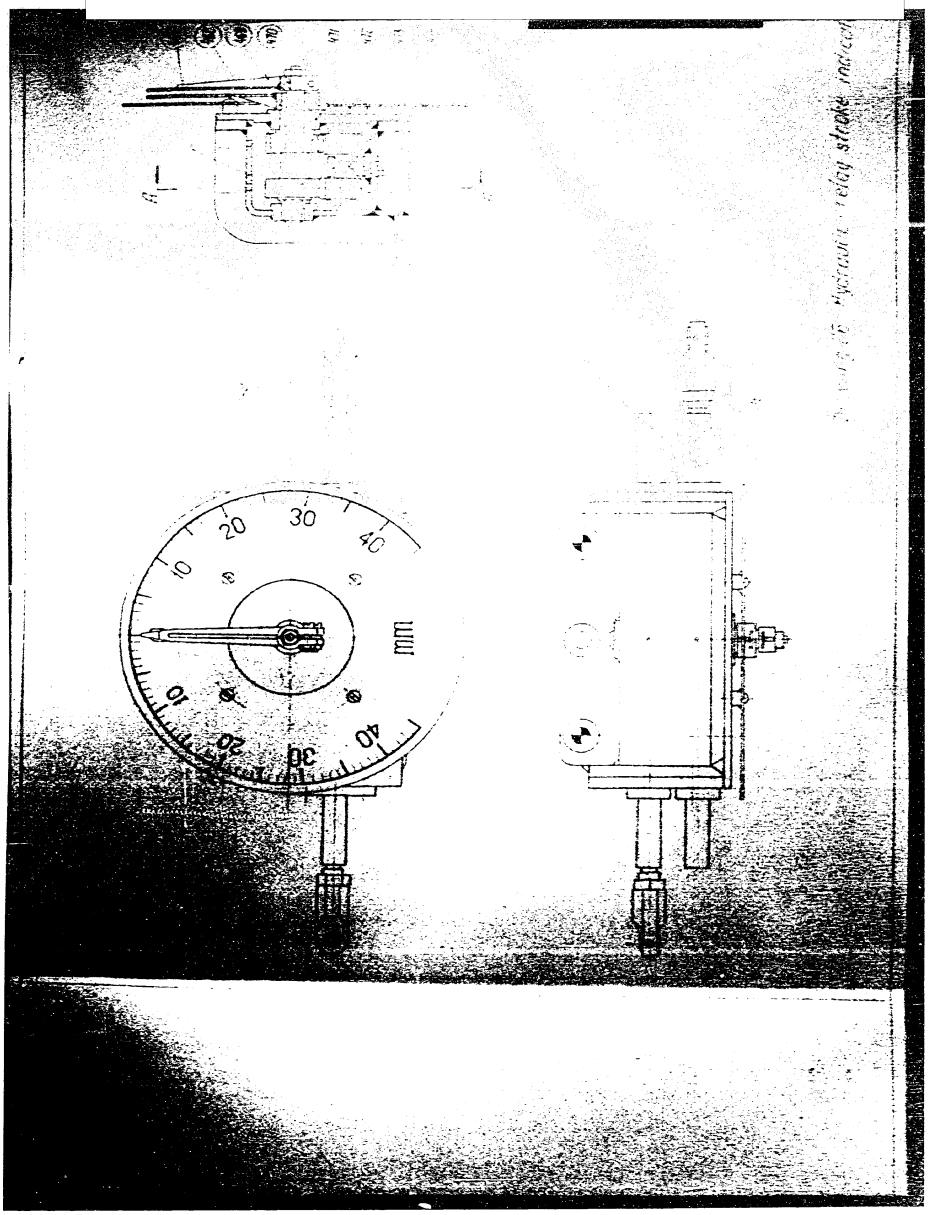

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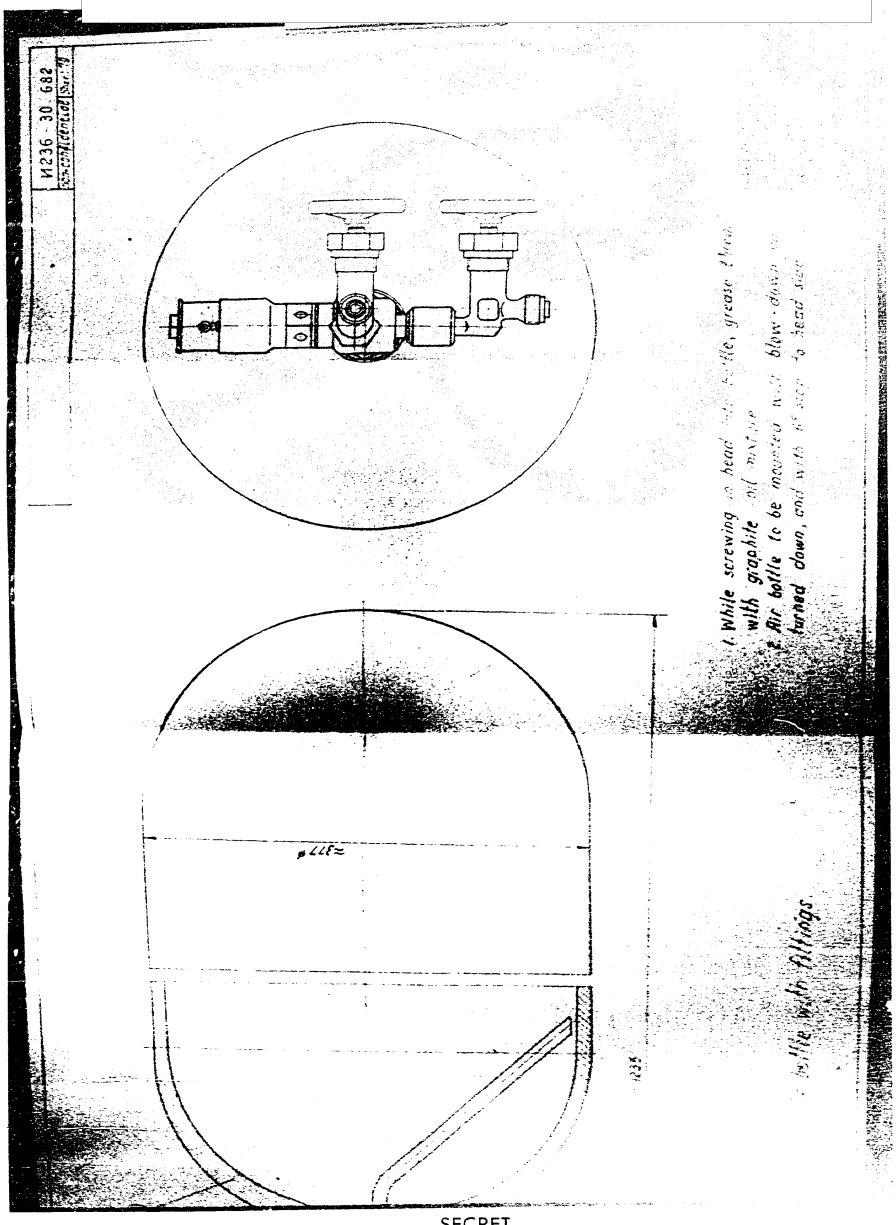

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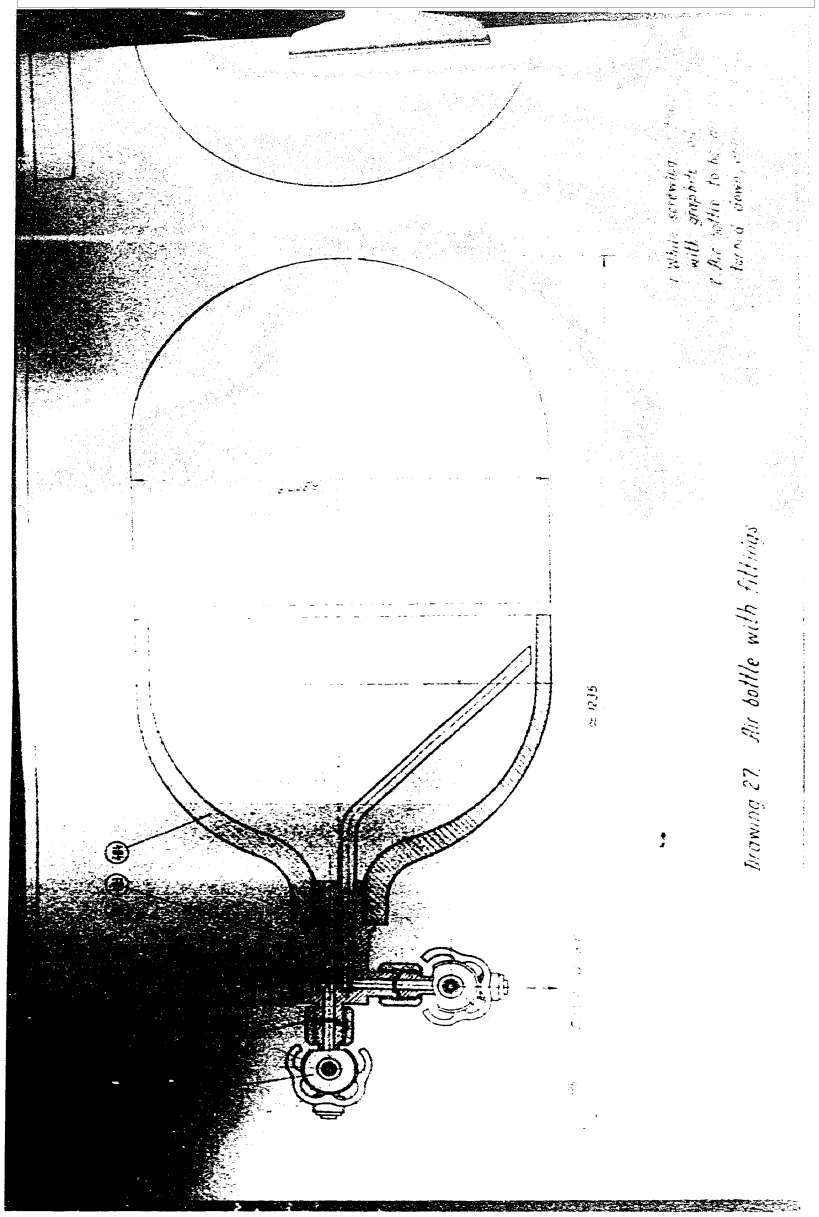

Drawing 27. Air bottle with fittings

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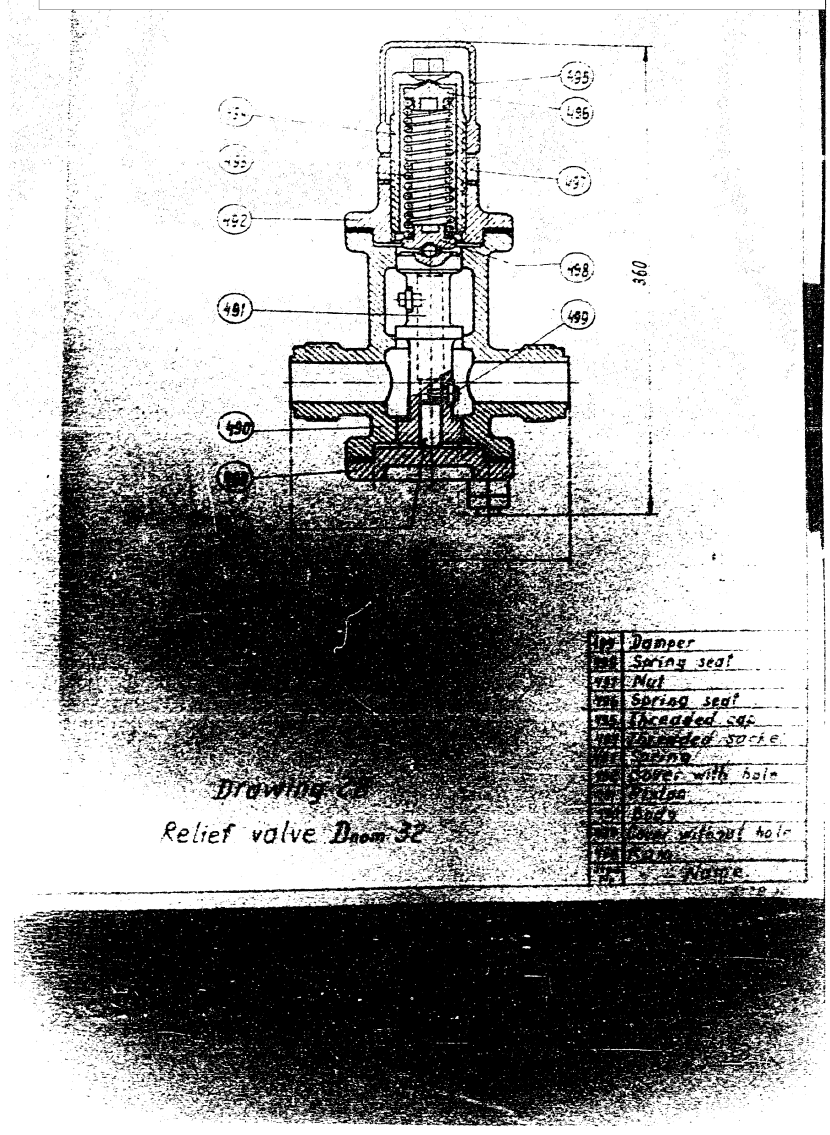

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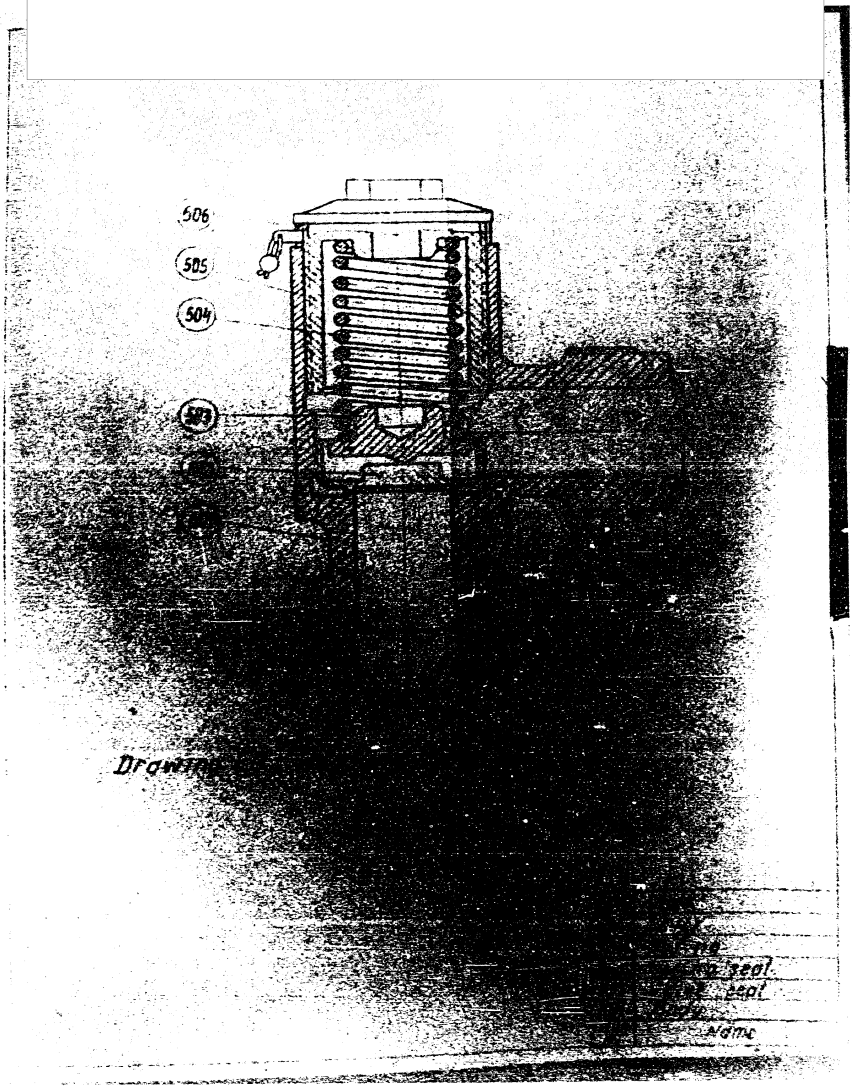

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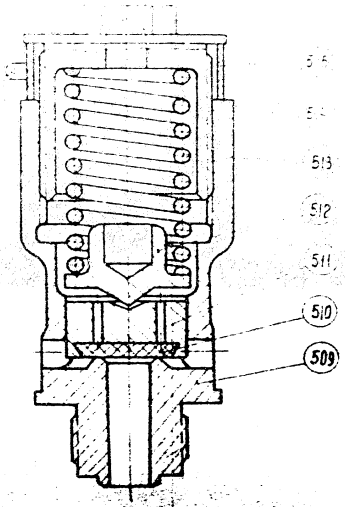

Drawing 30 Signal-relief valve

515	Lock
514	Cover
513	Spring
512	Spring seat
511	Valve seat
510	Gasket
509	Body
Pos.	Name

Size 12

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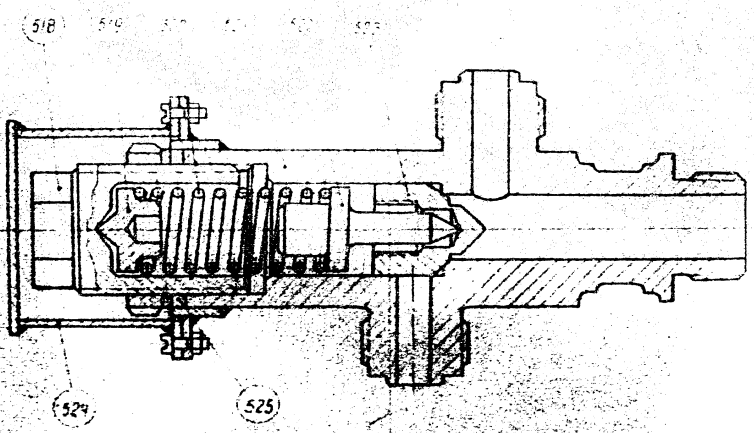

Drawing 31. By-pass valve

525	Face
524	Piston
523	Valve body
522	Spring
521	Body
520	Spring
519	Screw
518	Screw

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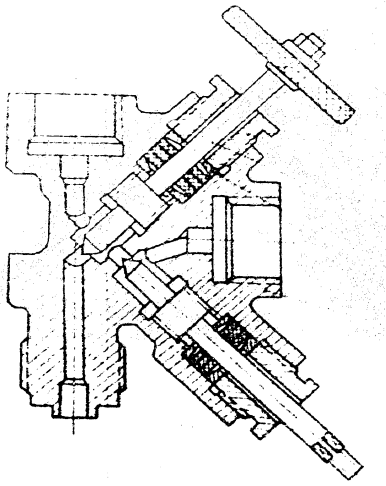

Drawing 32. Pressure gauge valve

	Valve body
	Check ring
	Handle
	Stem
	Hand wheel
	Plug

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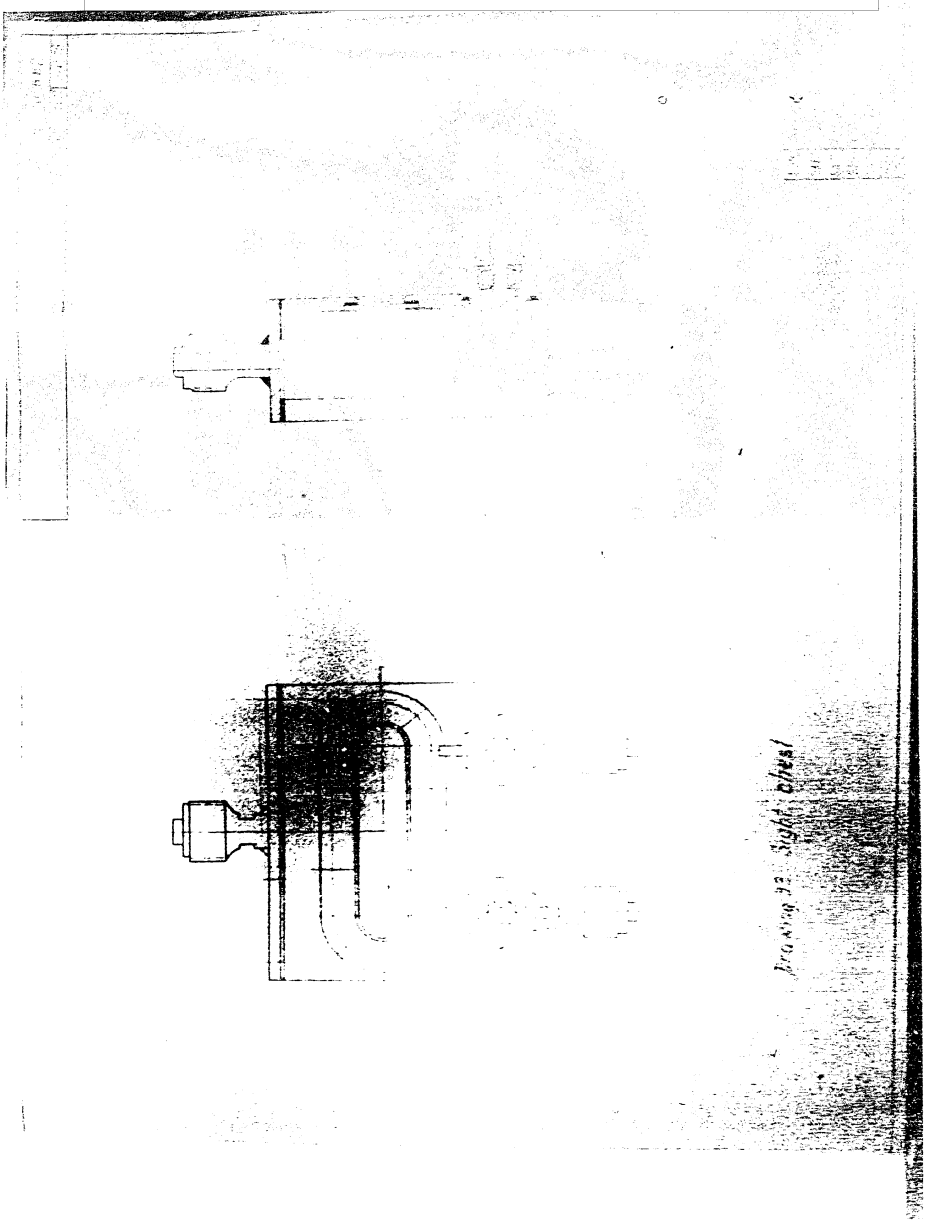

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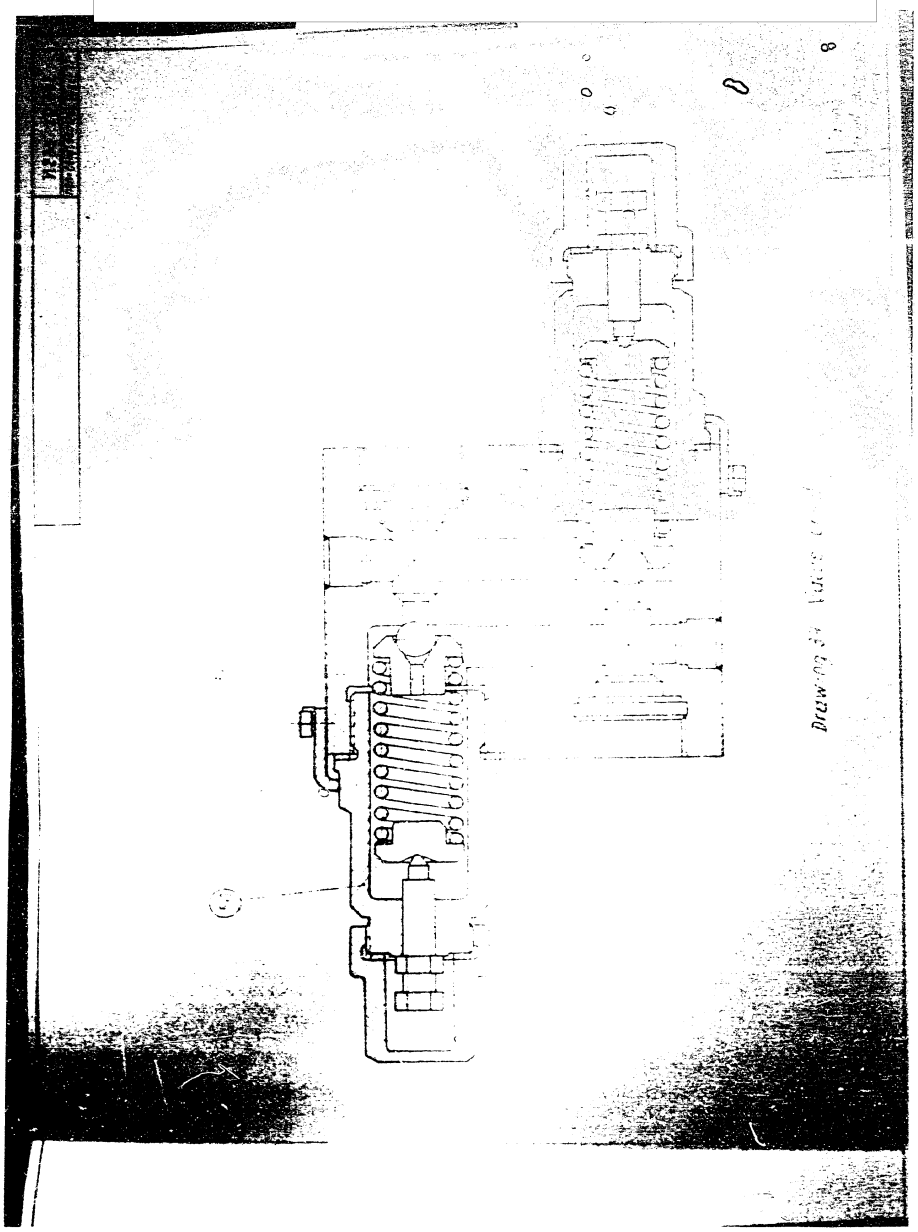

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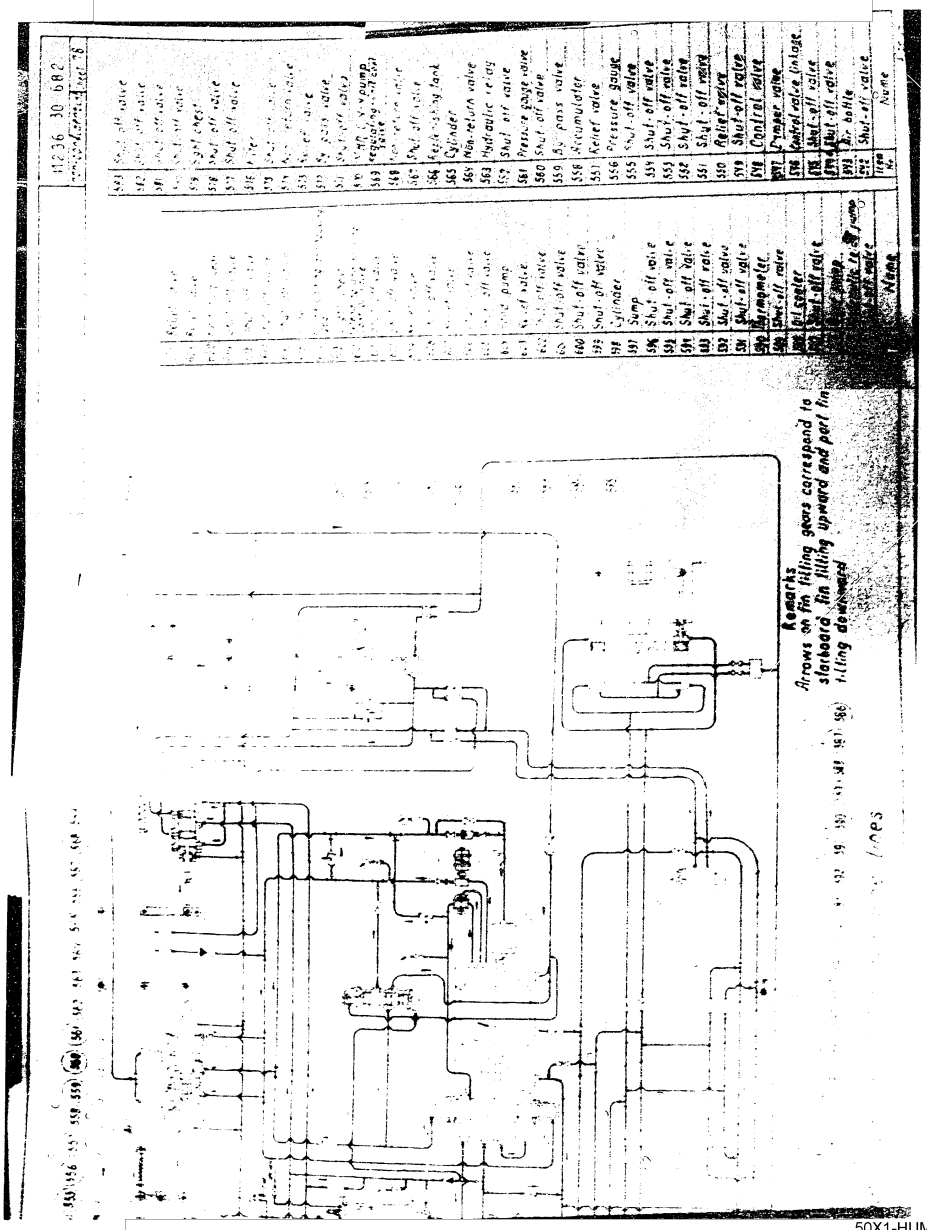

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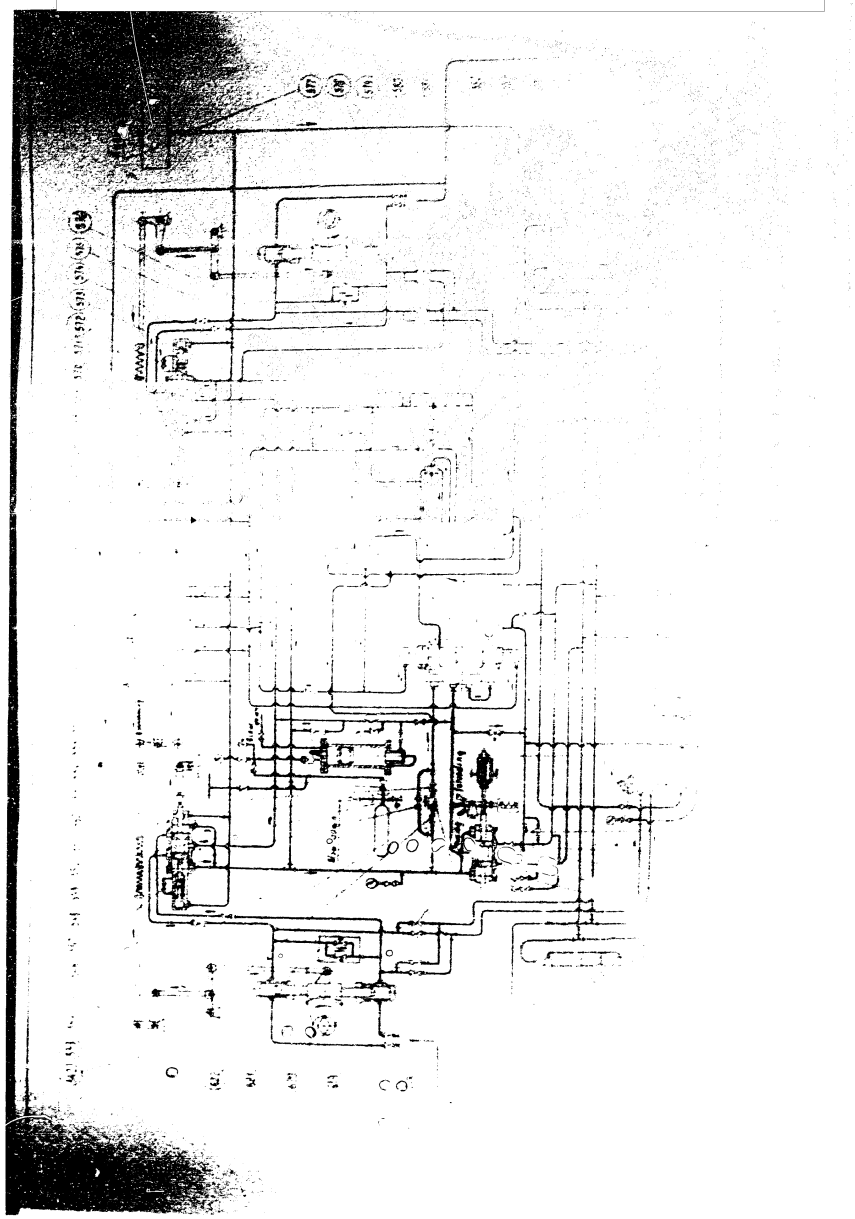

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